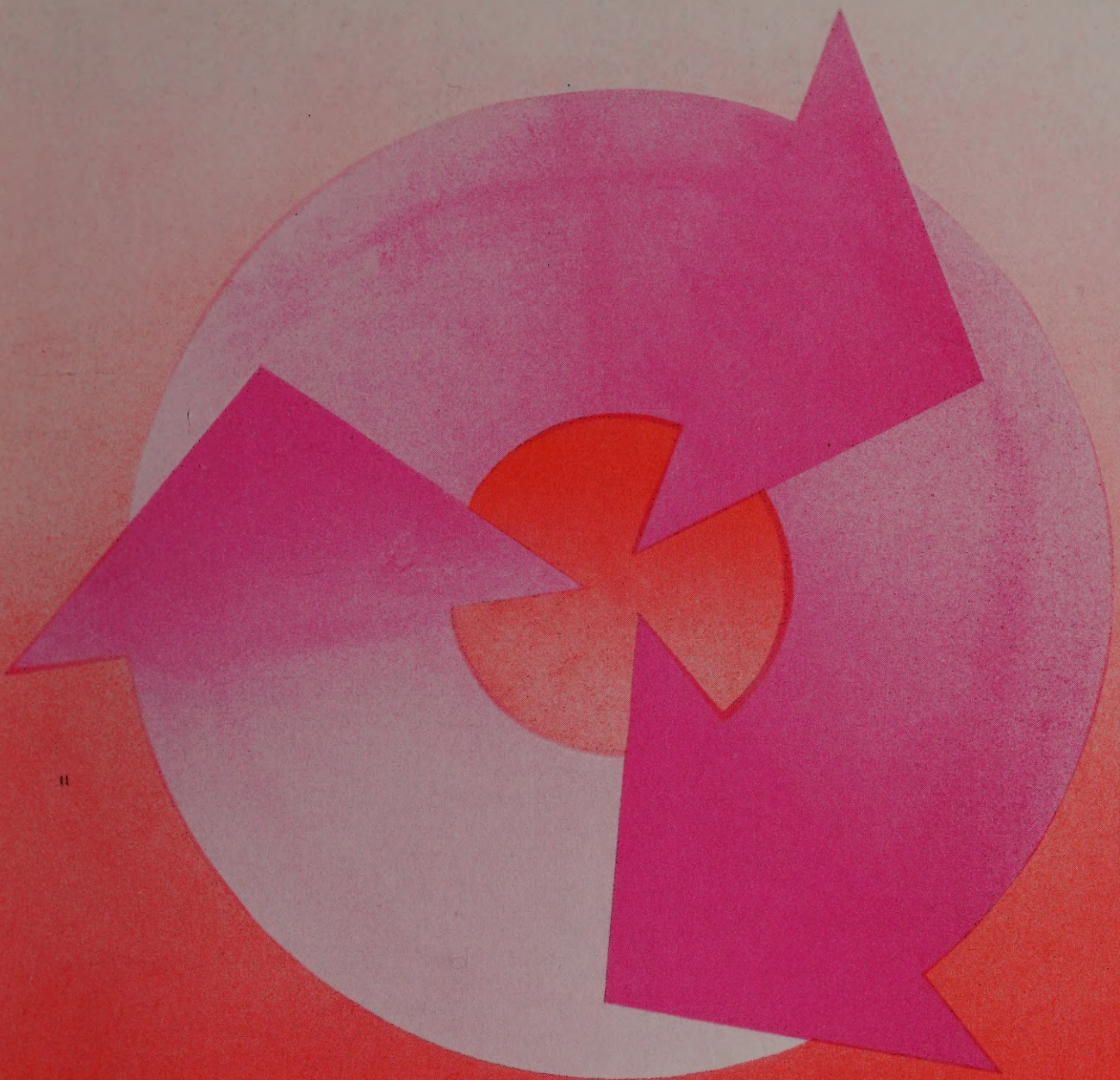

ALTERNATIVE ENERGY PATHS
UTOPIA OR REALITY ?

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CHRISTIAN SOCIAL THOUGHT IN A FUTURE PERSPECTIVE

The occasional study journal of the Sub-unit on Church and Society of the World Council of Churches

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The cover was specifically designed for this issue by Daniel Caselli, a Geneva based artist. *Alternative Energy Paths* represent radically different approaches to life styles and to attitudes to nature in general. The two colours represent the dialectical nature of this problem. Both future directions, however, are originally based on the same historical context. They develop from it in different directions, like the two colours fade out. The arrows bring attention to the need to look at these problems in cyclical and not linear or exponential ways. Recycling of materials (i.e. paper) and the use of renewable energy sources are parts of the cyclical attitudes. These should, however, be extended to our views on nature as well as on our fellow human beings, both now and in later generations.

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EDITORIAL NOTE

It has been almost two years since the last issue, No. 28 — December 1980, of *Anticipation* appeared. We must excuse ourselves for this delay, but given the smallness of the staff of the Sub-unit on Church and Society (presently 3) it is impossible to do a lot of publishing while there is a great deal of programme work going on. Indeed, since early 1981 there has been a lot of activity in this sub-unit. The staff had to prepare for, and organize a number of important meetings and conferences, which included two meetings of the Working Committee on Church and Society, the International Public Hearing on Nuclear Weapons and Disarmament, the meeting of the Working Group on Biological and Genetic Manipulation, three regional consultations of the Energy for my Neighbour Programme (ENP) in Asia and Latin America and the meeting of the Advisory Group of the ENP.

The time has now come to evaluate all this work and to publish some of the important results in our occasional study journal — *Anticipation*. This issue, No. 29, will be devoted to the activities of the Energy for my Neighbour Programme. We are also planning one more issue — the last one before the Vancouver Assembly of the World Council of Churches — No. 30 which will appear early in 1983. That issue will contain information about the rest of the activities of this sub-unit.

THE ENERGY FOR MY NEIGHBOUR PROGRAMME

The mandate of the Energy for my Neighbour Programme was for a period of two years, starting from December 1979. This was extended by the Central Committee of the WCC up till the next assembly, which will be held in Vancouver, Canada in August 1983. We welcome this decision, since it gives us more time to evaluate all the work which has been done in the area of energy by Church and Society since the last assembly (Nairobi, 1975), and specifically the activities of the ENP during the period 1980-1981. This will consequently enable the staff of the ENP to prepare more thoroughly for the Vancouver Assembly itself.

The main task of the ENP during 1980-1981 was to prepare for and organize a number of regional consultations on the theme "Toward more Just and Sustainable Policies for Energy Development" in underdeveloped countries. The original idea was to hold one regional meeting in each of Asia, Africa, Latin America, the Middle East and Pacific. After a great deal of preparatory travel and other activities in these regions, it was decided to hold the first phase of these consultations in Asia. Two meetings were held in this region, both in March 1981. The first was held in Madras, India for participants from Bangladesh, India and Sri Lanka. This was followed by the regional meeting in Chiang Mai, Thailand for participants from Burma, Thailand, Indonesia and the Philippines. Later in the year (October 1981) the second phase was started by holding a regional meeting for Latin America in Peru, near Lima.

In each of these regional consultations it was possible to invite approximately 30 participants, representing all walks of life, including church people, community developers, engineers, scientists, government civil servants, farmers, etc. The participants were all people from these regions — also living and working there. It has also been possible to invite representatives of various denominations, faiths and ideologies to each of these meetings, depending on the region. Thus there was a strong Hindu presence at the Madras meeting, Buddhist at the Chiang Mai, and Roman Catholic and Marxist at the Lima consultation. These have helped substantially to enrich our discussions, especially since in these respective regions these faiths and ideologies represent very large number of people — often the majority.

The 1979 World Conference on Faith, Science and the Future made the first attempt to work out ecumenical guidelines on energy. (See page 27) The results of these regional consultations contribute substantially to the refinement of these guidelines by presenting the point of view of people from underdeveloped countries, and specifically people living in rural areas.

The official reports on these regional consultations were published in 1981 and 1982 by the ENP office in various English and Spanish versions. In addition to these, however, there have been a number of local publications including parts of the consultation materials and the reports. A number of articles have appeared in the local press in India, Thailand and Peru. In Thailand, a whole book appeared in Thai — written by Dr. David Gosling, based on the Chiang Mai consultation. There has been a large demand for all these publications throughout the world.

Through such published media, as well as staff travel in these regions it has been possible to build up a rather extensive network of individuals, groups and organizations working in the area of energy development (at technical as well as socio-political levels). The staff of the ENP is at the moment in the process of compiling information about the activities of the members of this network. This information will be published in a small book early in 1983, and it is hoped that it will be a useful resource book for those who wish to increase contacts and effective cooperation between groups and organizations in the different parts of the world.

Unfortunately, it was not possible to hold regional consultations in Africa, the Middle East and Pacific. Although, thanks to very generous support from a number of countries, financially these consultations would have been possible, due to the closeness of the coming Assembly there was no time available. We hope, however, that these activities will take place in the period after the Vancouver Assembly.

A Buddhist monk from Sri Lanka, at the time studying in Chiang Mai, Thailand, discussing possible Buddhist-Christian cooperation in energy development work.

THE SIXTH ASSEMBLY OF THE WCC

The supreme administrative body of the World Council of Churches, the Assembly will be meeting in 1983 in Vancouver, Canada (See below). Amongst many important activities, the Assembly will also have to evaluate the work of the various units and sub-units of the WCC since the last assembly, and to propose guidelines for future work. In the case of the Energy for my Neighbour Programme (since its mandate will expire at the time of the Assembly) the Assembly, and its newly elected Central Committee will have an additional responsibility. It is these bodies which have the power to give a new mandate for future work in the area of energy, if they think it appropriate. The Advisory Group of the ENP strongly recommends that its mandate be renewed.

During the period between now and the Assembly, the staff is preparing the input of the ENP to the Assembly. There are a number of possibilities, the most obvious being through one of the "issues". These deal with the work of the various units and sub-units of the WCC, and issue No. 5, *Confronting Threats to Peace and Survival* includes, explicitly the concerns of the Energy for my Neighbour Programme. The ENP is also planning to make other contributions to the programme of the Assembly, including non-written materials, such as films, slide-shows and exhibits on the energy issue. We welcome any suggestions in this regard from our readers.

A few other publications are also planned before the Assembly, which can also be used as preparatory material in this subject area. These will include, for example small booklets evaluating various specific issues arising out of the regional energy consultation — primarily for use by parishes and other small groups of interested people.

THE SIXTH ASSEMBLY OF THE WORLD COUNCIL OF CHURCHES

Eight months from now, the Sixth Assembly of the World Council of Churches is scheduled to be underway. Constitutionally, the Assembly is the "supreme legislative body governing" the WCC, meeting about every seven years. It chooses from among its membership up to 145 to serve on a Central Committee which meets annually in the years between assemblies. But an assembly might more aptly be described as a family gathering of the world church, a time for its representatives to come together, look at where it has been, consider where it is going, and review issues confronting it now and in the years ahead.

Date :	24 July - 10 August 1983
Place :	Vancouver, British Columbia, Canada
Theme :	Jesus Christ — the Life of the World
Sub-Themes :	Life, gift of God Life confronting and overcoming death Life in its fullness Life in unity
Issues :	Witnessing in a Divided World Taking Steps towards Unity Moving towards Participation Healing and Sharing Life in Community Confronting Threats to Peace and Survival Struggling for Justice and Human Dignity Learning in Community Communicating with Conviction (Two more to be added)
Previous Assemblies :	1948, Amsterdam, Netherlands 1954, Evanston, Illinois, USA 1961, New Delhi, India 1968, Uppsala, Sweden 1975, Nairobi, Kenya
Cost :	The assembly's budget is SFr. 6.9 million. This includes some subsidies for participants from churches which need assistance with travel costs, but it does not include travel costs paid directly by member churches. Nor does it include the value of donated goods and services.
Delegates :	Up to 930, 85% elected directly by member churches, 15% elected by member churches after nomination by the Central Committee. The 15% category is meant to mitigate disproportions in the 85% category in terms of, among other things, confessional, lay, female, and youth representation.
Attendance :	About 4,000 total estimated, including delegates, journalists, accredited visitors, representatives of non-member churches, representatives of other Christian organizations, special guests, WCC staff, translators and interpreters, stewards, etc.

ALTERNATIVE ENERGY PATHS

The first part of this issue of *Anticipation* consists of the report of the Advisory Group of the Energy for my Neighbour Programme, which met at the Ecumenical Centre in Geneva, June 27 - July 3, 1982. The report speaks for itself, yet I would like to emphasize a few points because of their continuing importance, or because they are relatively knew and not yet widely known.

Energy as a Social Problem

The "energy crisis" is still looked at by too many as a crisis of resources and of technologies. "We need to find more resources" or "We need to develop nuclear energy much more extensively" or "We need to install biogas plants" are typical answers which people propose to the solution of the so-called energy crisis. The solutions concern the supply of energy, and only from a technical and sometimes economic point of view.

Our studies of energy related problems in the industrialized countries (in the 1970s) and in the underdeveloped countries (in 1980-82) show that there is much more to these problems than just the technical and economic questions of energy supply. First of all, even energy supply has other dimensions than just technical and economic. Political and other important social factors influence substantially decision makers in opting for one or the other kind of energy supply. Secondly, and perhaps more importantly, energy demand has also to be dealt with.

One has to ask questions, like : Who has an energy shortage ? What kind of energy is needed ? For what purpose is the energy needed ? Why cannot the present needs be satisfied ? At whose expense can some people always satisfy their energy needs ? Why do we use mostly non-renewable energy resources, when that is against the notion of Christian Stewardship to Nature ? These questions, however are not technical, but primarily social and ethical. Consequently meaningful answers can be reached only by looking at the political, cultural and ethical issues related to these problems. Therefore, the Churches also have a clear responsibility to contribute to the solutions of energy related problems.

This does not of course mean that the technical dimension of the "energy crisis" is unimportant. The point is that technologies should serve social goals and not the other way around. Thus, we ought to work out first the needs we have along with all the socio-political and ethical implications. Only afterwards should we consider what the technical possibilities are. Naturally, in many cases one has to work out the needs in the context of certain technical possibilities, so that the two cannot be completely separated. Yet, the emphasis that which is more important ought to be quite clear.

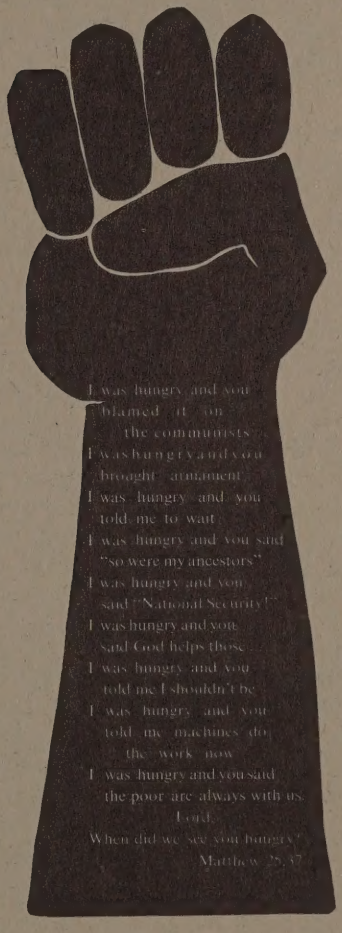
Woodfuel Crisis and Deforestation

Most observers would agree that one of the most serious problems faced by underdeveloped countries is the shortage of wood. The scarcity of this important raw material (for fuel, fodder, food and materials for construction and other industrial uses) has direct implications on the livelihood of people, on the environment, on industry and on the economy as a whole. These same observers, however disagree on who is responsible for deforestation.

Traditionally it has been the poor villagers who were blamed for burning up all the wood as cooking fuel. Although in some very high population density regions this could be true, in most cases the amount of wood used by villagers for their domestic energy requirements amounts to far less than what disappears from the forests. Although good data is difficult to find, it is increasingly evident that it is the needs of the urban-industrial areas for wood which are the major causes of deforestation. These needs include wood for fuel (both for industry and increasingly so for urban domestic needs, due to the exorbitantly high price of petroleum) as well as for timber for the paper and pulp and other industries. Forests are also cleared for other reasons, such as the need for agricultural land, but again in the majority of the cases, it is for the large agro-industrial companies which will produce cash crops for sale (usually for export) and not for the simple farmers for their day-to-day existence.

Justice or Charity ?

Somebody said recently that the situation in the world is so serious that just to give charity is not good enough. Indeed, the injustices in the global economic system; in the way resources are distributed (or not distributed); in all kinds of global and local institutions are so thoroughly ingrained that no amount of charity can counteract them. Or perhaps, charity needs a new definition ? Is giving some of our excess to the poor charity ? Is sending 0.3% of our Gross National Product as aid to underdeveloped countries a charity, when it is such a small amount, and at any rate we profit from it at the end, because the money we give can only be used to purchase our own products ? If charity does not result in more justice, than indeed it cannot be called charity, but perhaps a way to relieve our conscious.


I was hungry and you
blamed it on
the communists
I was hungry and you
brought armament
I was hungry and you
told me to wait
I was hungry and you said
"so were my ancestors"
I was hungry and you
said "National Security!"
I was hungry and you
said God helps those
I was hungry and you
told me I shouldn't be
I was hungry and you
told me machines do
the work now
I was hungry and you said
the poor are always with us
Lord
When did we see you hungry?
Matthew 25.37

In the area of energy assistance, this problem is well illustrated. We all agree that the people living in the underdeveloped countries will need more energy so that they may improve their physical quality of life. So our development agencies have collected large sums of money to buy biogas plants, windmills, diesel pumps and a host of other appliances with which it was hoped the poor would improve their standard of living. Church organizations, however, are not the only ones having such ideas about energy assistance. Governments are also involved in such transactions. "Technology transfer" is the name of the game, but governments have much more money than churches, so they send nuclear plants, oil refineries, etc., and the World Bank decides to fund huge eucalyptus plantations in India to ease the wood shortages.

The report of the Advisory Group, as well as some of the other articles in this issue deal in detail with the problems posed by these attempts at energy assistance. At this point it suffices to say that except for a few special cases they do not work. They do not work, because in all of these cases the "assistance" process imposes a specific technical solution, which had been developed in a different socio-economic context, to a problem, which is largely socio-economic in nature. Donated biogas plants break down; eucalyptus plantations provide wood for the paper and pulp industries and not the poor; thermodynamically efficient cookers are used as flower pots and so on, because the problem in the first place was not a technical one, but to which a technical solution was applied.

North-South Dialogue
"The main point is to talk to each other."

What can the rich do, to help their poor brothers and sisters? Some radical critics would say: Nothing! because whatever is done will probably turn out bad. Most people, however, would recognize, that there is a role to play for those who have more than others, but this role should result in more justice and not just simply giving the surplus away as charity. In practical terms, this means for example support (financial, political and moral) for educational programmes, popular organizations, liberation movements and other activities in the underdeveloped countries, which contribute to their **own** self-liberation and self-development. Authentic development cannot come from without. It must come from within, and energy development is no exception to this.

Utopia or Reality?

The present global energy situation is very difficult. Governments and energy planners are still sticking to traditional approaches to energy problems and as a result it is unlikely that the situation will get better in the near future. As the rest of this issue of *Anticipation* also shows, the situation is not hopeless. Everywhere in the world, there are people attempting to realize radically new concepts of life styles, of attitudes to the world around them. These attempts are resulting in new ways of harnessing nature (i.e. technologies) which are much more responsive to the environmental and socio-political constraints of our times. Specifically, in the area of energy supply and use a great deal of advance has taken place.

Some government officials and representatives of energy corporations still would like to convince us that such alternatives are a utopia. Looking around the world, however, tells us that it already is a reality.

In many underdeveloped countries it is being realized that it will not be possible to solve the tremendous energy problems faced by the rural areas by relying on conventional, centralized energy sources alone. China is perhaps the leader in this area, but other countries are also thinking about entirely new ways for rural energy development. The pioneering work of dedicated people in the 60s and the 70s, who have demonstrated the viability of alternative systems, is now paying off.

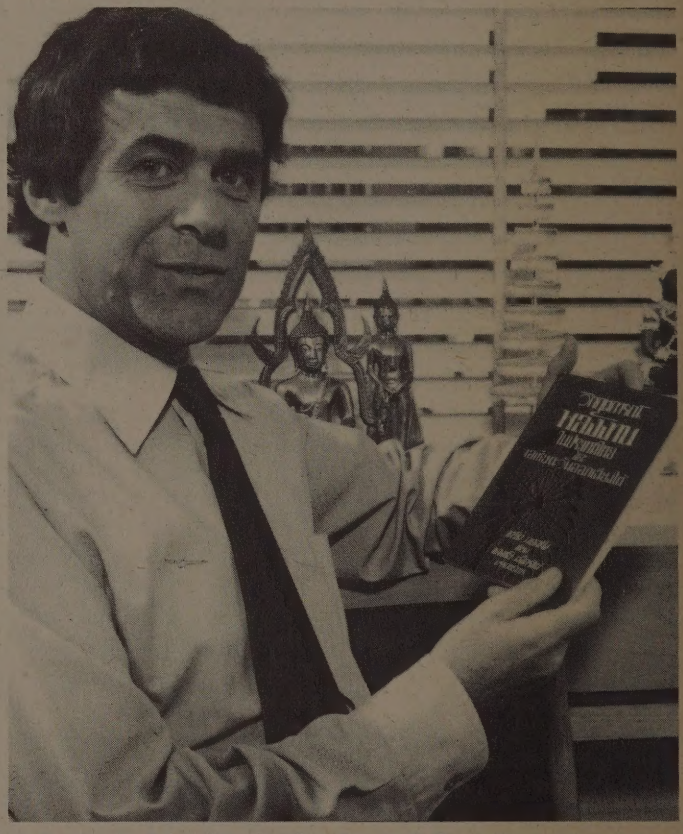
The industrialized countries, although still too slowly, are also toying with radically new approaches. In some countries, pressure groups for alternative life styles and energy use and supply (e.g. the *Greens* in the Federal Republic of Germany) are beginning to make an impact.

There is still a long way to go. The path to more just, sustainable and participatory energy policies and consequently to societies will not be easy and will not be without costs. Only if we are convinced about the need for and the utility (not only in an economic but also in a socio-political and ethical sense) of these alternatives will our work be easier.

* * *

The second part of this issue contains a number of articles. Some of these were specifically written for *Anticipation*, while others were reprinted from other journals and books because of their relevance for our work.

Dr. David Gosling, a long time member of the Energy for my Neighbour Advisory Group attended the United Nations Conference on New and Renewable Energy Sources in August 1981 as the official representative of the ENP. He took with him our written contribution which was later distributed to all the participants. He wrote this article for *Anticipation* as his personal evaluation of this meeting.



Dr. David Gosling, holding his book in Thai — based on the Chiang Mai energy consultation of the ENP. (The translated title: Energy Crisis in Thailand and in South East Asia*).*

The article written by Prof. David Hall and his colleagues was reprinted from a book, which appeared under the same title as the article. The authors discuss the social and political factors which have to be taken into account when implementing biomass based energy strategies in underdeveloped countries. The proposed strategies are mainly intended for rural areas.

The next article has been excerpted from a book written by Robert Taylor for the Washington based organization, *Resources for the Future*. The book deals with attempts by the Chinese Government to introduce decentralized energy systems in the rural areas of the Peoples Republic of China. The article which is

published in this issue is the conclusion of the book. Neither the book, nor the article reprinted here give a "blueprint" for rural energy developement. Mistakes as well as success stories are discussed. There is, however, a great deal of information which could be useful for other underdeveloped countries also.

Rusi Engineer wrote the following article about the problems of the lack of wood and deforestation in India. He gives an excellent review of what the problems are, but more importantly he proposes a number of interesting solutions. These proposals are also substantiated by a few examples, where such approaches have been tried and which seem to be succeeding. This article first appeared on the pages of a Bombay journal, *Business India*.

John Dillon, the co-ordinator of the GATT-Fly group in Toronto, Canada, wrote the next article for this issue. He compares a few energy policy issues in three countries : Canada, Mexico and Brazil. Inspite of the huge differences between these countries, one finds that there is a lot of similarity in the way problems of energy policy are approached by their various governments. What is striking in his article, is that when everything is counted, the export of oil can be a money loosing business — especially when the technology and the know-how to exploit the oil wells have to be imported.

The article following deals with a problem, which is generally not talked about. Energy poverty is not only a phenomenon of the underdeveloped world. David Ostendorf's article shows that even in a rich country like the USA, the poor physically suffer because of the exorbitant price of energy. Although it is evident that the absolute level of suffering (if such a level could be defined ?) of the poor in the USA is much lower than that of the poor in rural Africa, relatively speaking this is even more shocking than the situation of the latter.

Iain Macdonald touches the same issue in his article, but in the context of Scotland. He also writes about the experience the Church of Scotland gained in attempts to make church buildings more energy efficient, and consequently church members more energy conscious.

Phyllis Creighton writes about the experience of one Anglican parish in Toronto trying to translate into practice the notion of Stewardship to Nature. Even though her story does not end well, it is a success story because the people who tried now understand why it did not work. Indeed, even the seemingly practical question of using a solar water heater is fundamentally a theological issue.

The article by Günter Altner discusses the specific problems faced by the people of the Federal Republic of Germany in terms of deciding their energy future. There is, at present, a *de facto* moratorium on the future construction of nuclear plants in the FRG. The author analyses what this means for those who wish for a different energy future than the one being proposed by the government and the energy corporations.

Finally, the article by Fred Pearce on Acid Rain points to a very serious externality of the way we use polluting fossil fuels for the production of electricity and for the running of the cars. Acid rain does not recognize any frontiers and large damage can be caused by it even thousands of kilometres away. This serves as a good reminder that we live in One World, and we will have to work together on the solutions of such Problems.

Janos Pasztor
Energy for my Neighbour Programme
Geneva, November 1982

A woman in Bangladesh sticking cow-dung on jute sticks to be used as domestic fuel once dry.

REPORT OF THE MEETING OF THE ADVISORY GROUP OF THE ENERGY FOR MY NEIGHBOUR PROGRAMME

At the Ecumenical Centre, in Geneva, Switzerland June 28 - July 3, 1982

I. INTRODUCTION

Energy is basic to all human activities. We need energy in the form of food to survive in a biological sense. Energy is fundamental in handicrafts, village and large-scale industry. Energy is what makes everything work — without it no activity would be possible and life would simply stop.

The availability of all major energy sources is constrained, by a number of technical, economic, political and cultural factors. Some are in short supply; others are too expensive; still others have unacceptable environmental impacts associated with them. Commercial fuels, most of which are fossil sources like oil and coal, are traded on the markets with the appropriate economic and environmental constraints on them. Non-commercial or traditional fuels (on which about half of humankind exists) are mainly biomass, that is wood, animal wastes and agricultural residues. For these at present the major constraints are the sustainable yield and the time and effort available to collect them. For the longer term the major constraint is the availability of technologies through which these sources can be exploited in much more efficient ways. Naturally, for both commercial and traditonal energy sources the existing socio-political and cultural constraints are equally important.

The analysis of the patterns of supply and use of energy by societies lead into some fundamental questions about the nature of society and social relations, as well as about the relationship of humanity to the rest of creation.

One of the most important social concerns of the Ecumenical Movement has been for the poor, deprived and oppressed. A number of WCC programmes are at present dealing directly or indirectly with questions of development through which it is hoped to ameliorate the human condition in those areas most in need. In many cases, the energy process and its ramifications seem to be the major constraints on these development efforts. This is not only true in cases of domestic or industrial use of fuels *per se*, but it has direct implications on the very livelihood of the people.

A large number of people are unable to purchase or acquire enough quantity and sufficient quality of energy for their needs, because of their low purchasing power or insufficient political power. As the rest of the report will argue, many people in the underdeveloped countries will not be able to achieve higher standards of living precisely because they do not have access to energy. This is evident and has been extensively documented. It is less evident, however, that a large number of people are kept in relative and absolute poverty in the industrialized world, for exactly the same reasons.

Physical poverty, however, is not the only issue. Highly centralized sources of energy (at present mostly in the industrialized countries, but more and more so in the rest of the world) are becoming increasingly complex and consequently unparticipatory. People become alienated from such technologies. The complexity of technological systems, such as a large nuclear power station or a solar satellite producing electricity makes people powerless. They resign and accept the energy, regardless of how it is produced, as long as it is available at a reasonable price. This is happening more and more in the highly industrialized countries. Even when people do care, it is often impossible to effectively participate due to the apparently enormous complexity, and sometimes deliberate mystification of the issues. As a result those who control these technologies (e.g. energy corporations, governments, etc.) can and to control the people who depend on energy from such technologies.

The balance between **"hard"** (e.g., centralized and usually dependent on non-renewable fuels and material inputs) and **"soft"** (e.g., less centralized, dependent on renewable fuels and other materials) energy options will substantially influence the way of life styles, social relations and societies as a whole develop in the future. The relationship between them will require further economical attention.

The energy dimension must be dealt with **explicitly** in all work related to development efforts in both the industrialized and the underdeveloped world. Energy gives us a good entry point into the overall debate, because it is so basic to all processes. It must, however, be remembered that energy does not become the "aim" in itself.

II. THE CHURCHES' INVOLVEMENT

The rapidly changing nature of the global energy situation presents a continuing challenge to the churches. In the last nine years the Sub-unit Church and Society has given a great deal of attention to studying these issues at an ecumenical level. (See page 26) It began by looking at the ethical and social aspects of nuclear energy, eventually broadening into the full range of energy issues through the activities of the Energy for my Neighbour Programme (ENP) in the underdeveloped countries, where a number of regional consultations were held. [1]

Today it is increasingly recognized that energy is a critical factor in development. The availability or otherwise of sources of energy often determines the quality of life of a people and whether their lives are abundant and human or degraded and inhuman. (See page 7) The energy crisis of the 1970's has meant for many

Continued on page 8

ENERGY USE AND THE QUALITY OF LIFE

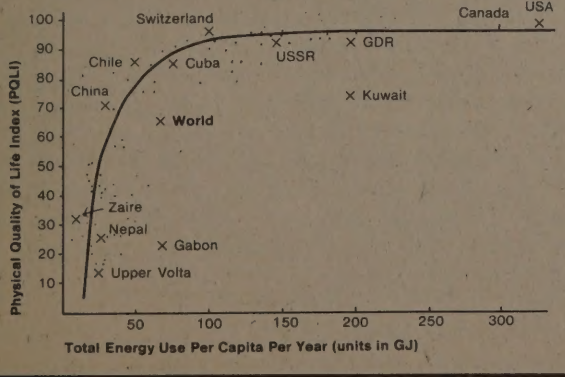
It is a sad fact of the 20th century that alongside the fantastic scientific and technological developments which have taken place, about half of the people living in our world cannot even satisfy their basic individual needs. Although most of these people who live in misery and poverty are found in the underdeveloped countries this is not exclusively so. It is evident that in most cases energy shortages or the inability to utilize energy sources are not necessarily the causes, but indeed often the results of poverty and exploitation. Analyzing patterns of consumption and energy supply, however, can be very helpful in discovering some of the underlying causes of this poverty and exploitation. Finding out the relationships between energy consumption and physical life quality are steps in this direction.

In order to quantify such a relationship we need a measure of the physical quality of life. Social scientists have, however, devised an index which is relatively simple to use.Instead of looking at all the input variables, three measurable quantities are used which reflect whether the fundamental needs of a group of people have been met or not. It is called the Physical Quality of Life Index (PQLI), and the three variables are: infant mortality, life expectancy and education. Obviously, if the basic needs are met a certain child will survive (as measured by the infant mortality) and will eventually live a long life (as measured by life expectancy). However, since there is more to human survival than simply biological survival, one more important variable — education — was included in the PQLI.

Tables of PQLI can be found in various publications. [1] They range from 0-100 where the extremes can never be reached. The rich countries fall into the high 90s while there are very few countries where the PQLI falls below the 20s. In general, one can say, that if the PQLI is above 75 then on the average misery and poverty have disappeared.

There are two major drawbacks to using PQLI in this fashion. The first one, as mentioned above, is that it only measures the physical quality, while often spiritual and other qualities could be not only more important, but could themselves effect the physical quality of life. Secondly, it is a statistical figure, which means the average of a large number. Correspondingly, in a particular country, there might be a great many people living with PQLIs way below, as well as way above the average, without even considering the distribution within the particular sample.

Values for the per-capita energy consumption for countries can be found in any energy statistics book. [2] For this comparison both commercial and traditional sources of energy are used. These values for per capita energy consumption and Physical Quality of Life Index are plotted on the figure below. Each dot represents one country, but only a few of them can be identified for lack of space. Although there is a great deal of scatter of points, there seems to be an approximate functional trend between the two variables, as shown by the thick black curve. There are a number of important observations one can make by studying this figure.



First of all, there seem to be two major clusters of points : one at the bottom left hand corner and another at the top right hand corner. While, the former have low levels of energy consumption generally less than about 40 GJ and scattered but also low levels of PQLI — between 15-50, the latter have rather high values for PQLI, mostly above 80 and scattered values for per capita energy consumption, in general more than about 75 GJ. It is, therefore, evident that when energy consumption is very low, the physical quality of life index will also be rather low, while at high energy consumption values the opposite is true. The situation is highly polarized; the countries are either poor with low levels of energy consumption or rich with high levels of energy consumption, with very few countries in between.

The second important observation concerns the slope of the graph. At the low end of this curve, for countries such as Nepal and Upper Volta, even very small increases in the per capita energy consumption values could result in relatively large improvements in the index for physical quality of life.

This makes sense, since in a poor village somewhere in Upper Volta, even one additional water pump could help substantially in supplying drinking as well as irrigating water. Similarly, the availability of more fertilizers (which are mostly energy based) could help a great deal in increasing the agricultural yields, thus reducing malnutrition and dependency on food aid.

As we move up on the curve each additional gigajoule of energy produces less and less increase in the quality of life. Around the level of 100 gigajoules per capita the curve flattens out completely and there is no indication of the fact that increasing energy consumption at that level could increase further the physical quality of life index. This also makes sense, since once such high levels of energy consumption are reached the variables which go into PQLI, i.e., infant mortality, life expectancy and level of education will have been maximized as much as is humanly possible. They cannot be increased by additional activities using more and more energy.

It can be concluded, therefore, that upto a certain level there exists a relationship between energy consumption and the physical quality of life. Especially at very low levels of energy consumption small increases in per capita energy use can result in large increases in the physical quality of life. It appears from the figure that there is a minimum level of energy consumption of about 60-70 gigajoules per capita per year to reach minimally reasonable levels of PQLI (assuming that each gigajoule of energy can produce the same utility). ■

Notes

1. PQLI figures were taken from *Energy in the Developing World*, eds. Smil and Knowland. Oxford University Press. 1980. p. 372.
2. Per capita commercial energy consumption figures are from *Yearbook of World Energy Statistics*, United Nations 1979. Traditional fuel consumption data was calculated from data found in *Prospects for Traditional and Non-Conventional Energy Sources in Developing Countries*, World Bank Staff Working Paper, No. 346. Washington, DC. 1979.

millions a further deterioration in their living standards resulting in malnutrition, disease and death. It is the Christian concern for all God's people that compels us to consider the human and ethical implications of policy decisions regarding energy.

At present there is a wide imbalance in energy use among nations, as well as within nations. In North America the average person uses three times as much energy as the average European and about 30 times as much as the average rural African. [2] Although we are not advocating that everybody in the world should be using energy at the same rate as people in North America (even if that were a practical possibility), it is evident that in many parts of the world increases in the availability of energy would lead to reduced misery and poverty. Such imbalances are, however, not restricted only to the so-called underdeveloped world. In the United States of America, for example the low income households use only half as much electricity and only three quarters as much natural gas than even just the average household ! (See page 48) The quality of energy being used is also very important. The rich have easy access to convenient energy sources like petroleum, while the poor have to contend with dirty coal, wood collected on the roadsides and increasingly with cow dung.

The churches have a clear obligation to plead for more just and sustainable policies of energy use among all nations of the world. In fulfilling this task they must take sides with the poor, speak for generations yet unborn, draw attention prophetically to the inevitable consequences of present policies for mankind, claim for people the right to participate in making decisions that shape their lives and look further ahead into the future than most national leaders are willing to do.

Many of the decisions concerning energy are taken independently of those whose destinies are shaped by them — especially and increasingly the poor. Some are consciously taken by Governments and individuals committed to a greater or lesser extent to a just distribution of energy resources. Others occur by virtue of the continuation of policies which automatically benefit particular interest groups.

The imposition of policies which determine the destinies of groups and individuals has a dehumanized effect which is incompatible with the Christian Gospel. True human development, based on the notion of corporate growth "towards the measure of the stature of the fullness of Christ", involves every aspect of the human personality, and cannot be imposed by God or man "from above" or "from outside". This is not only true at a theological level, but can be seen in practical terms by looking at the result of insensitive aid policies which have ultimately done more harm than good to their recipients.

Patterns of colonialism and its more recent manifestations have helped to mould the conventional view that all the poor of the earth require for their development is more resources, more energy, more money, more scientific and technological gadgets. Even Christian agencies have fallen into the trap of thinking in this way. But it is not true. Much as the poor — in terms of basic human needs such as food, shelter, education, etc. — need resources, they can only develop in the fully Christian sense if they are provided in such a manner as to increase rather than reduce the range of options open to them.

People are too often prevented from participating in the technological and economic decisions which shape their lives. They must be given the opportunity to explore the potential choices open to them and to move progressively towards greater self-determination. Churches have a responsibility in helping this process. This will involve not only education of the people themselves but in some cases a confrontation with structures and vested interests.

The future of the world is too important to be left only to those who currently shape its path — whether directly or by default. Those who argue for *laissez-faire* attitudes and the "magic of the market place" must understand that in doing so they are condemning the poor to greater poverty. They are also failing to recognize latent instabilities in their own economic and political systems which may ultimately plunge the whole world into chaos. Energy planning, by virtue of its central role within these systems, thus becomes of crucial importance.

Applied science and technology do not acquire momentum independently of the societies in which they function. They assume specific proportions and degrees of complexity because either those societies as a whole or interest groups within them wish them to do so. It is naive to imagine that energy technologies develop independently of any social context and that all that is ultimately required is that people learn how to live with them !

Christians involved in the energy debate must go to the heart of the issues by examining how and why certain technologies and strategies have evolved and why they assume their present form. Otherwise they will never achieve more than marginal adjustments to systems which not only do seriuou serious damage to the poor but are inherently unsustainable. They must understand, for example, that deforestation is not caused primarily by cutting wood for fuel but by the prevailing methods by which the urban-industrial interests exploit forests. What is happening now to forests in the underdeveloped world is essentially the same as what once happened to the forests of Europe and North America. As this is not generally known, Christians, by virtue of their commitment to truth and participation in decision-making, have a special responsibility to see that such information is made readily available. Only then will the majority be sufficiently informed to know how best to act.

The Christian Gospel is primarily about action, and it is only due to a Western distortion that too much emphasis has often been placed on cerebral "belief". **Jesus Christ — the Life of the World** — must revitalize his followers to act in a world which stands at the cross-roads betwen the global sharing of resources and chaos.

The sharing of God's gifts presupposes that all people are at the very least neighbours if not members one of another. Christians have a mandate to work for the liberation of their neighbours — the whole creation — so that they will be able to participate in the choices which shape their destinies and those of their descendents.

Our neighbours on whose behalf we struggle so that they and we together may enjoy fullness of life in Christ also include the rural and urban poor of the underdeveloped world, and increasingly of the industrialized North. They also include those who will succeed us and whose lives will be shaped by the decisions that we make now.

A frequent criticism of Western theology has been that it has concentrated on the redemptive work of Jesus Christ to the exclusion of other aspects of God's revelation in our world, not least His presence and activity in Creation. This criticism is to some extent a fair one and it is this imbalance that has lead us to be less mindful than we should have been of the need to live in harmonious relationship with the whole created universe. One of the consequences has been the, by now almost total acceptance of the Promethian view of the Universe. Within this, modern science and technology are the two most important tools humanity has to interpret and relate to reality, with the aim to exploit nature for its benefits. Theological thinking has substantially influenced their development, with misinterpretations of certain biblical texts largely being responsible.

The opposite, however, is also true in that the results of new developments in science called for theological justifications, since

Man always likes to go about his business with a good conscience. In this regard, theology has played the role of an ideological safeguard, if one understands the function of ideology as an *a posteriori* justification of the already existing *status quo*. This can help to explain why and how some serious misinterpretations of certain biblical texts could develop in the Judeo-Christian tradition. They served the ideological purpose of sanctioning the *status quo*.

One of the most important misinterpretations has been that of Genesis 1:28.

> God blessed them and said to them, "Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish of the sea and the birds of the air and over every living creature that moves on the ground."

This text has been completely taken out of context, so as to give Humanity the mandate to exploit nature entirely for its own ends; to look at nature as a factory serving humanity and to disregard the possibility that nature might have intrinsic value. Man was taken out of, and placed above nature. Genesis 1:28 was used to create an assymetrical and violent conflict between humanity and nature.

Such misinterpretation of this text has contributed to the rationale for scientific development over the last few centuries, but especially since the 17-18th centuries. This had effects not only on the relationship between humanity and nature, but also between men and women as well as between Christians and non-Christians. Science and technology became the tools to conquer nature and the whole world. They have become the tools of an eschatology based on the capabilities of humanity as opposed to those of the Almighty God.

Indeed, the churches have an authentic and inescapable responsibility with the worldwide energy problem. Many seemingly technical debates rest on ethical assumptions, implicit or explicit, and have ethical consequences. Others involve fundamental theological issues, some of which even provoke questions about the very meaning and the boundaries of human life.

The churches cannot, and are not being asked to "solve" the worldwide energy crisis. This is clearly impossible, and it is not their role. They are, however, being asked to fulfil their responsibilities by contributing to these contributions based on their theological, ethical and subsequent social work in this area.

III. ENERGY POLICY AS SOCIAL POLICY

The energy crisis — traditionally viewed as a crisis of supply — has been defined by technical constraints. The solutions to the oil crisis, the wood-fuel crisis and the electricity crisis, and so on are to explore for more oil, to plant more trees, to install more photovoltaic electricity systems. But this preoccupation with the "energy supply crisis" and the subsequent emphasis placed on technical solutions not only overlooks the "energy demand crisis" but also veils the social side-effects and the underlying socio-political assumptions of the various energy supply options.

Energy Needs

It is not energy in its primary form such as black gooey oil or bulky wood that people want but energy services that are provided by these forms of energy : heat for cooking, mechanical power for moving, and electricity for lighting. Any energy planner should start by asking "What are the energy needs of the people ?", "What energy services will enable the people to raise their standard of living ?"

Energy Demand

The "energy crisis" is less a crisis of supply than a crisis of demand. For the short and middle term, on a global basis, there seems to be enough fossil, hydraulic, fissile and biomass sources to meet every person's basic, and often more than basic needs. For the longer term, direct and indirect solar energy and a few other energy sources can clearly satisfy all the energy needs of our globe, whose population will increase to and stabilize around 6-7 billion people. The problem is not the non-existence of energy sources *per se*, but more like the access or rather the non-access to them. Many people, mostly in the underdeveloped countries, but also many poor in the industrialized ones do not have enough money to have access to these energy resources, either by buying land on which the resources are located, or technologies by which the exploitation of the resources may take place. The energy crisis is therefore a crisis of access to energy — it is a crisis of the distribution of resources at global as well as local levels.

This Sri Lankan woman has seven children and she has to spend a few hours collecting firewood every second day so that she can cook for her family.

Energy as a Mask for other Problems

Energy problems are often used as masks for other problems.

- debate over energy pricing can be a mask for debate of social equity;
- conflicts over the laying of oil and gas pipelines, especially when they involve indigenous people, can be covers for struggles over land rights;

- controversy over energy technology exports from the industrialized to the underdeveloped countries is just one component in the restructuring of North-South relations;

- condemnation of OPEC for its contribution to the mounting debt of underdeveloped countries and to the worldwide recession divert attention from some of the much deeper, fundamental economic injustices in the world market system, in which the OPEC nations are only contributors — and certainly not the most important ones.

And yet these energy problems are portrayed not as social problems but as technical problems. Discussions about technicalities, about mechanical details of energy supply options, while necessary at some point, alone in the energy debate are devices to divert people from consideration of the underlying principles of social justice : rights, equalities and responsibilities.

Energy Systems are not Value Free

The commonly held belief about any technology growth and change is that the application of new technologies *per se* is a correct step in the path of development. This belief has as well guided the growth of energy technologies in both the industrialized countries and the underdeveloped countries. However, several studies on the science-technology-society linkage have shown the absolute incompleteness of such mechanistic approaches. The interdependence of social forces on the one hand and scientific and technological growth on the other has been established in great details.

The socio-political structure of a society mostly guides the evolution of scientific-technological knowledge in the current stage of development. Cognitive inquiries about fundamental laws of nature are largely intermixed with technological research for new products or processes. The growing tendency for centralization of political and economic power is reflected in a similar tendency in the growth of centrally controlled technologies in the field of energy.

Energy systems are not value free. The energy path of a country is dictated by the policy of the elite in power. The energy path, in turn, influences the future social organizations. Through the transfer of socially harmful and inappropriate energy technologies, the industrially advanced countries create new social problems in the underdeveloped countries. The growth of energy technologies, whether by transfer or indigenous, must be in tune with the popular needs, consistent with the goals of the majority of the people's lives and be ecologically sound.

For example, nuclear technology — because of its highly complex nature — will only be understood by a very small segment of a population. A society that adopts nuclear power, then, has accepted a policy that discourages individual control over a basic form of energy. Similarly, nuclear power, for its safe operation, requires a great deal of regulation. This has meant unusually stringent security checks of workers at plants, the need for secure transportation routes for nuclear wastes and fuels, increased use of police forces by electric utilities, and enough other threats to civil liberties to have elicited the concern of bodies like the American Civil Liberties Union. An energy policy that favours nuclear policy, therefore, exposes society to the risk that its civil liberties may need to be curtailed. As well, nuclear power, like any large-scale electricity system, requires large nearby markets to minimize transmission costs. A nuclear power policy now becomes a policy that favours urban centres over rural areas.

The choice of decentralized energy technologies will lead to dramatically different social policies. Windmills, for example, are an ageold technology found around the world, invariably built with indigenous resources to meet varying local needs. A society that adopts windmills then, has accepted a policy that permits individual control over a basic form of energy. As well, windpower can be produced in small quantities and so does not require large markets nearby. An energy policy that favours windpower, therefore, is a policy that does not discriminate against rural areas.

Not surprisingly, the energy technology that is chosen tends to be consistent with the biases of those doing the choosing. A farmer, responsible for meeting his own energy needs, would tend to prefer windmills — a source of energy he understands and can control — to nuclear plants. A planner in the Ministry of Energy, charged with meeting the energy needs of the country, would tend to prefer administering one new nuclear plant to perhaps the 6,000 windmills required to produce an equivalent amount of power.

An industrialized country that transfers its own energy technology — whether through aid or trade — to an underdeveloped nation is not only shaping the recipient's energy policy but also its social policy. For this reason, the social implications of all energy systems should be well understood by industrialized and underdeveloped countries alike. The peril of forgoing this understanding could well be a new generation of imperialism — energy policy imperialism.

IV. DEFORESTATION — THE MOST URGENT CASE OF ENERGY RESOURCE DEPLETION

Mining, not Managing Renewable Resources

The history of human civilization has been greatly modulated by man's capacity to extract, store and utilize energy resources. Except in the current century in which man has depended heavily on fossil fuels and to some extent nuclear fuels, the history of energy resource utilization has been that of direct use of solar energy or indirect use stored in biomass through the process of land utilization. The basic forms of energy for human life, like food, come from land, as do the basic resources for maintaining the animal powers, so vital to the process of food production in the underdeveloped countries. Resources like firewood, bushes or agricultural wastes, also a direct product from land are necessary to the essential processes of cooking and space or water heating. These renewable energy resources have served humanity for ages, very dependably. Unfortunately history of human civilization not only speaks of this vital dependence on land for energy, it also warns us against humanities' evergrowing demands on nature. The impact of this everincreasing demand has been the quick degradation of this vital resource base and in some parts of the world the degradation has led to processes like soil destabilization, thus damaging land to such an extent that the seemingly inexhaustible renewable resources like forests have become non-renewable.

In the underdeveloped world, traditional energy sources — wood, animal dung, draft animal power and crop residues — are all renewable but in many locations are together being consumed at rates faster than they are being replaced, that is at rates faster than the sustainable yield rate. As deforestation accelerates, people turn to burning dung cake as an energy source. At one time used as a fertilizer if burnt this organic matter and most nutrients in the dung are lost. With less fuel people switch to food that requires less or no cooking time and coincidentally has low nutrition value. To meet the energy needs of the family more children and women are needed to spend more time going further afield to collect wood. With deforestation and the diversion of dung for fuel the land is more vulnerable to the direct blast of the air and the rain. The run-off rate of water increases, floods follow, and precious topsoil is swept away. This topsoil runs into the river systems, causing siltation of the reservoirs, damages the turbines and reduces the life expectancy of hydroelectric dam systems that

provide the urban areas with electricity. And so the land produces less and the vicious circle continues. People migrate to the cities where they switch from wood to charcoal. Because of the energy lost in the process of converting wood to charcoal, twice as much wood will be required to cook the meals and heat the same houses. The huge population increases in many underdeveloped countries are further exacerbating this problem.

The mining of non-renewable resources (hydro-carbon reserves, mineral deposits, etc.) pollutes environmental assets — air, water, land — which reduces the carrying capacity of the land and jeopardizes the renewability of resources.

Renewable resources such as forests and farmland are mined by environmentally intensive management practices. In Canada, for example, for every 10 trees cut down by the forestry industry, only three are replanted. [3] In industrialized countries in general energy and capital intensive monoculture agriculture systems are responsible for the run off of the topsoil causing a drop in the watertable, erosion, and a loss of organic material and minerals in the soil.

Production and consumption of goods and services threaten the renewable resource systems. The burning of coal and other fossil fuels for electricity production and use of oil in automobiles contributes to the spectres of "acid rain" and the carbon dioxide build-up in the atmosphere. (See page 60) Acid rain threatens reproduction of organic material; carbon dioxide can not be recycled without organic material to convert it in the photosynthetic process to carbon — the fundamental source of energy.

Number of Barrels of Oil Bought by One Tonne of Each Commodity in 1975 and 1981

The exorbitant price of crude oil is hurting the poorest countries most. These countries rely for their foreign exchange earnings on the sale of agricultural or mineral raw materials. The international price of these commodities has substantially dropped in the last decade, while the price of oil has increased. This means that the poorest countries are forced to sell more and more quantities of their raw materials for less and less oil. The table below lists a few important raw materials and the number of barrels of oil a tonne of each could buy in 1975 and 1981 respectively. The ratio of the 1975 to the 1981 levels are also shown for easy comparison.

	Barrels of Oil		
COMMODITY	1975	1981	Ratio 1981/1975
Copper	115	57	0.49
Lead	39	23	0.59
Tin	641	425	0.66
Zinc	67	24	0.34
Aluminium	73	45	0.62
Cocoa	148	60	0.41
Coffee	148	82	0.56
Tea	129	69	0.54
Sugar	42	15	0.36
Cotton	119	56	0.47
Jute	35	10	0.27
Rubber	62	41	0.66
Soya Beans	19	9	0.45
Maize	11	4	0.41

Ultimately we all, citizens of the underdeveloped and industrialized countries alike, rely on the land to absorb and produce the organic material necessary for life. Present practices undermine the carrying capacity of the earth with resource husbandry techniques that **mine** rather than **manage** global resources.

The world's tropical forests are disappearing at very fast rates. Depending on the region, it is expected that most of the humid tropical forests of the world will disappear within the next 25-30 years.

The situation is particularly alarming in most of the underdeveloped countries in which the vast majority of the rural population has no access to other energy sources and the existing resources are turned into a platform for the scramble for biomass between the commercial-industrial demand and the rural needs. Industrial needs for wood, either in the form of fuel or timber for the paper and pulp industries have increased tremendously in many countries.

	1967		1976	
Countries	Percent total biomass[a]	Percent total industrial energy[b]	Percent total biomass[a]	Percent total industrial energy[b]
Argentina	51	20	80	38
Brazil	12	28	15	17
Colombia	3	73	6	29
Egypt	84	17	87	14
India	3	3	5	4
Indonesia	1	58	2	40
Iran	29	9	31	2
Mexico	26	5	30	3
Thailand	52	20	93	28
Venezuela	8	3	14	4

Dependence of Industry on Biomass in Selected Countries [4]

(a. The percentage of all biomass consumption that is consumed by the industrial sector.
b. The percentage of all industrial sector energy consumption that is biomass.)

Often, the reasons behind deforestation do not have anything to do with the need for wood. Large areas are being cleared in the Amazonian region, for example, for agricultural and cattle raising purposes, from which almost exclusively transnational corporations will benefit. It is evident that in this scramble the politically and economically weak, the rural poor will be left high and dry, while the products of the forests will be widely available in the expanding industrial sector. Indeed, it is becoming increasingly clear that, except for a few regions where there is a very high concentration of population for a given number of trees, it is not the domestic woodfuel needs of the people, but rather the needs of the urban-industrial sectors for woodfuel, timber or agricultural land which are responsible for deforestation. [5]

The methodology of organized forest management in almost all underdeveloped countries has been historically guided by forces that want to destroy the traditional control of the local people and enforce a control by the commercial-industrial interests. Examples of such destructions are available throughout the world.

Case Studies

1. Kenya [6]

The replacement of a system of forest management based on community ownership with one based on private property may be responsible for replacement of community mechanisms that controlled access to the forests with the conception of state or "common land" that made the forests everybody's but nobody's. The transition occurred under colonial rule in Kenya with an act that privatized land holdings. The intention was to provide an incentive to the owner for investment in his land by issuing land titles, assuming that agricultural productivity would not increase until property rights were clearly vested in the individual, not the community. The impact on the forests has been disastreous. It is likely that community mechanisms governed and assured access to the forests over time. There was no desire to take more than was needed because what one family did not take today would still be available tomorrow. Upsetting that social code thus upset the security of communal resources as well as one's accountability to fellow community members for use of communal forest resources.

2. India [7]

Forests were traditionally managed and kept in a perfect health. However, soon the British turned to the Indian forests for the requirements of the Royal Navy and later the expanding railway network in India. Friction between the local people and the outside forces led to significant loss of forest. Added to this pressure on forest land was the use of forest land for agriculture, river valley project industries, urbanization, etc., which has so far taken toll of more than 4 million hectares of forest land. That the crisis of Indian forests is much more due to the unlimited requirements of the urban areas and the forest based industries than the limited need of the forest dwelling communities becomes evident from the comparison of forest resources in areas of equal pressure of population but unequal commercial exploitation, as well as the tremendous growth of forest based industries in the last two decades. [8] The result of such practices obviously got reflected in the fact that while the stipulated minimum forest area is 30% of geographical area only 22% is available today, of which about half may be considered forest according to strict silvi-cultural standards.

The crisis in energy resources in the rural areas of the underdeveloped world is, thus not a total resource crisis. It is a crisis created by mining of timber as a method of forest management. There are serious social, political and cultural dimensions to this crisis. The traditional and ecologically stable method of control and management of forest resources was replaced by the bureaucratic one by the imperial rulers. This destroyed the fabric of community organization and control as well as restricted the area identified for community purposes significantly. The local people had to depend on very small part of the whole forests became alienated from the forests quickly. Thus the built in mechanism of community control over forest exploitation deteriorated and people, as individuals, pushed by poverty and unemployment, became active participants in the game of plundering forests together with the commercial interests. Slogans of saving the ecosystem for the future generation becomes illogical, misplaced and absurd in conditions of poverty where the existence of the present generation becomes possible only at the cost of hurting the ecosystem. As far as the case of forest resources are concerned, society has reached a stage where the crisis can be characterized as an emergency. Afforestation of suitable species is needed at an equal footing. In the process of regeneration of resources the regeneration of community control is essential and here the energy question requires dimensions far above the narrow technical one. It now can be seen as a fundamental socio-econo-ecological problem closely linked with the pattern of distribution of resources.

The skewed distribution pattern that dominated the process of deforestation now, threatens to dominate the process of afforestation also and all those who are concerned about the condition of the common people the world over need to take steps to identify processes of afforestation from the people's point of view. This process, however, has already started in various parts of the underdeveloped world and most remarkable among them may be the Green Belt movement of Kenya and Chipko movement of the Himalayan forests in India.

Ways to Go

1. The Green Belt Movement

The few examples of successful projects to increase the supply of energy available to those in both developing and developed countries are found in the efforts of the non-governmental organizations(NGOs). One such example is found in the Green Belt Project run by the National Council of Women of Kenya. [9]

This project to reforest community land in rural villages, now several years old, is constrained by many factors, one of which is the inability of the forest department to provide enough seedlings for communities requesting them.

If a community wishes to join the Green Belt Project they contact the National Council of Women, then appoint a committee of village representatives, choose a plot of land to plant the trees (usually near a school or some other community building), organize a day for which the community members volunteer their labour to plant the trees, and then nominate an unemployed — often handicapped — villager to tend the seedlings. From the beginning the community is involved in decisions as to where the trees will be planted, and who shall tend them.

The role of the National Council of Women is to carry the initiative of the community through the bureaucratic process of acquiring the seedlings and to assist in the structuring of the community apparatus to plant and tend the trees. Initially the seedlings were provided only by the Forestry Department. But the inability of the Forestry Department to meet the overwhelming requests brought to them, has led the National Council of Women to set up their own nurseries. The unparalleled success of this programme in Kenya is attributed to its reliance on and integration with the community.

2. Chipko Movement

"Chipko" a Hug Tree movement [10] was started by the hill women in the Himalayan district of Chamdi as a step to safeguard the local people's rights on the forest products from the growing demands of the industrial sector. It later grew into an unique ecological movement for saving the Himalayan forests in India spanning from Kashmir in the North-West to Kohima in the South-East. The common technique used is to hug a tree when the axemen of the contractors arrive in the forests. The movement leaders have demanded a ban on commercial felling and afforestation by the local people is going on. The movement has been a successful methodology for regaining community control over resource management.

Deforestation in the Industrialized Countries

Inspite of the emphasis of the media on deforestation in the underdeveloped countries, this phenomenon is not restricted to them. North America is one region where this is true. In Canada, for example, under the terms of the Confederation the provinces own 90% of forest land within provincial boundaries. While the provinces have pre-eminent jurisdiction over the forest resource and thus ultimate responsibility for replanting and forest management, the federal government can influence forest management through fiscal incentives to replant, and research and development programmes to study and develop environmentally sustainable forest management systems. The fact that for every ten trees cut in Canada only three are replanted and that politicians on the

campaign trail never fail to promise the required attention of this renewable resource rests with failures of political and legal systems to identify and implement sustainable resource management practices.

Ways not to Go

One of the most commonly thought culprits of deforestation is the "highly inefficient" woodfuel cooking-stove used by the majority of the people in the underdeveloped world — ½ of the world's population. Testing of traditional cooking techniques — either the three-stone stove or the charcoal stove made from scrap metal or clay — suggests that the thermal efficiency of these techniques is a frightening low of 5-10% (about 5-10% of the energy content of the wood or charcoal is actually being used to cook the food, the rest is dissipated into the atmosphere).

Now after ten years of unsuccessful attempts by virtually every aid agency to improve the thermo-dynamic efficiency of these stoves, we are discovering that : [11]

- measured under real life conditions, the traditional three-stone cooking stove proves to be not only versatile but very efficient when tended carefully. Fine tuning of the heat control is done quite simply by feeling or withdrawing the branches (which feed in the stove like the spokes into the hub of a wheel) from the fire;

- the metal charcoal stoves like the three-stone stove do more than just cook. They provide space heating, lighting, smoke to reduce insect populations, drying or flavouring food, and of course, they provide the same social benefits that lead those in the developed countries to invest in fire-places and wood-stoves. When all the energy end-uses — not only cooking — are included in the calculation of thermal efficiency the picture changes dramatically. Stoves that are more efficient as cookers do not provide all the other energy services mentioned above.

The Chipko Movement : *While hugging the trees the women chant : "Himalaya wake up today ! Drive the cruel axe away !"*

In view of the dimensions of the crisis over the husbandry of natural resources the world over, the smaller questions of resource management integrate into the larger questions of human existence and satisfactioon of basic human needs. The unsuccessful stories above teach us lessons what not to do. The successful ones, on the other hand should make it possible for the churches to take up such experiments all over the world. Their concerns should be mainly around the question of people's control over the resources and not simply around the technical solutions of energy resource utilization problems.

V. NUCLEAR ENERGY

Introduction

At the MIT Conference on Faith, Science and the Future in 1979, [12] the participants passed a resolution calling for a five-year moratorium on the construction of additional nuclear power plants throughout the world. The resolution called upon member churches to support, during this period, the widest possible discussion regarding the social, military, economic, political, environmental and safety aspects of nuclear power programmes. This resolution, passed by a three to one majority was later endorsed by a narrow majority in 1980 by the WC Central Committee. [13]

At the MIT Conference, delegates recognized that the WCC does not have the political or enforcement power necessary to halt the advance of nuclear power programmes in individual countries. However, the delegates were aware of the significant power of the WCC to influence public opinion through the actions of churches and church members. The call for a moratorium was the strongest possible statement of concern from the delegates regarding the need for continued debate and reassessment of the role of nuclear energy in both industrialized and underdeveloped countries. The "moratorium", as such, was limited to the somewhat arbitrary period of five years so as not to portray the impression of an unconditional condemnation of nuclear power.

Since 1979 (and indeed earlier), the worldwide nuclear industry has been struggling to survive. The world recession accompanying the rapid rise in oil prices in the 1970s was one of several factors causing a fall in demand for new nuclear power plants. A *de facto* moratorium on nuclear power growth throughout the world has actually existed since the MIT Conference. As a result, the debate over nuclear energy has been somewhat dampened, and, in some nations (particularly in the underdeveloped world), was made less urgent. Recently, many nuclear industry observers and public interest groups have even predicted an early death for nuclear power. This is one of the reasons why some analysts have shifted former strong concerns over nuclear power development to the recent and disturbing developments in the area of nuclear arms.

Ironically, it is at this very time that a host of novel technological and policy-related developments could spell a new and prosperous era for the nuclear industry, increasing the applicability and use of nuclear power throughout the world, particularly in underdeveloped nations. As a result of these new developments, many of the old themes and issues that were once central to the nuclear energy debate are now altered, broadened, or even eliminated. Consequently, there is now a need for more, not less, scrutiny of nuclear power developments — in addition to the large amount of attention now being devoted by the churches to the issue of nuclear weapons.

New Developments

Some of the latest developments described below, such as the very small, prefabricated nuclear reactors or the laser isotope separation of nuclear fuels are still very new and have not fully reached the commercial stage. Every indication is such, however, that they will soon do so. It is highly desirable, especially from the point of view of the churches that the socio-political impacts resulting from their introduction be properly evaluated **before** and **not after** their implementation.

It is also evident that the question of nuclear power cannot be addressed in a vacuum, without properly evaluating the overall patterns of energy supply and demand. This has been dealt with at length in previous ecumenical studies concerning nuclear energy. Often, in underdeveloped nations the primary issue is not nuclear or something else, but whether it is possible to supply the energy needs of large rural populations with central station electricity at all ? The developments listed below, therefore should be looked at with these assumptions in mind.

1. Procurement of Uranium from Seawater

When demand for nuclear energy was rising rapidly in the 1970's, it was generally thought by industry planners that the need for uranium fuel for conventional nuclear reactors would one day outdistance resources which would be economically obtained. At some point in time, they argued, it would become necessary both to develop plutonium-fueled breeder reactors (which produce as much nuclear fuel as they consume) and to extract (or recycle) plutonium from spent nuclear fuel for use in other plutonium-fueled nuclear reactors.

Since plutonium is potentially weapon-grade material, much of the former debate among the churches over nuclear energy centred on the dangers of this seemingly inevitable use and transport of plutonium in what was foreseen as a future "plutonium economy".

Today, however, that debate changes. Using new techniques now under development in the industrialized world, it may soon be possible, using filters and resin beds, to obtain vast resources of dissolved uranium in seawater at a cost as low as US$ 200 per pound or less. [14] While this cost is still well above the current market price of mined uranium, it is low enough so that electricity production from recycled plutonium fuel and breeder reactors would be more expensive than that from reactors using only uranium fuel. Since ocean resources of uranium are practically limitless, it would be hard to justify the introduction of breeder reactor and recycle technologies on the basis of resource shortages. Though it would not eliminate present risks of weapons proliferation from civilian nuclear power, uranium-from-seawater technology has the potential of limiting the proliferation risks that would be associated with this one aspect of nuclear power — the so-called plutonium economy that is now on the agenda in many nations. While this may be viewed as a positive development, there are other developments, described in the following sections, which may increase the risk of weapons proliferation from commercial nuclear power.

2. Small Prefabricated Nuclear Reactors

Until recently, most underdeveloped countries' aspirations for nuclear power have amounted to wishful thinking. All but a dozen of so were technically disqualified from the nuclear power market because their electrical systems were simply too small to accommodate the giant reactors that had become standardized in the industrialized world at a size of about 1,000 megawatts. This left the vast majority of the underdeveloped nations without a realistic nuclear energy option. Even today, there are only 10 underdeveloped countries having electrical systems large enough to allow reliable operation of a 1,000 megawatt reactor.

But manufacturers in Great Britain, West Germany, Japan, the United States, Canada and France have now begun development of "small" prefabricated reactors of 50- to 200-megawatt size whose capital costs may be low enough to justify assembly-line production. [15] These reactors, according to the latest industry plans, will be constructed at single factory locations in the industrialized world mounted on barges (or even railroad cars), and shipped to virtually **any** country in the world. [16] There are more than 70 underdeveloped nations, for example, whose electrical systems will be large enough to permit reliable installation of a 200-megawatt reactor by the year 2000.

Manufacturers also foresee a potentially large market for these small reactors in the industrialized world, where high interest rates, lengthy construction schedules and political opposition are weakening the prospects of giant reactors.

To date, the development of small reactors by manufacturers has preceded any analyses of the implications of this new technology. Yet, most of the suppliers' individual governments are now supporting, with financial aid and technical sponsorship, programmes to develop and export small reactors. [17] But these reactors will change more than simply the size of the nuclear "market". There are many associated issues that deserve serious study before extensive commitments are made by any nation to small reactors, some of which are listed below.

- Present international programmes to control the proliferation of nuclear weapons, already deemed inadequate by many agencies and governments, may be altogether insufficient to monitor a greatly expanded market for nuclear power in the underdeveloped countries.

- There are currently few international nuclear safety regulations governing the construction, installation, operation and maintenance of nuclear power plants. It is the sovereign prerogative of each nation to design and shape individual regulatory programmes. Thus, competing manufacturers, in efforts to capture new markets, may be tempted, if allowed, to compromise the standards of their own countries when exporting reactors to the underdeveloped countries. This practice in some actual cases has led to the installation of reactors that would be difficult or impossible to license in the suppliers' own countries. [18]

- Previous nuclear transfers to the underdeveloped nations have been difficult, lengthy exercises involving participation of the underdeveloped countries in many aspects of construction, operation and even design. The new "turn-key" small reactors will be introduced almost instantaneously to the purchasing nations — involving little or no local participation or subcontracting. Thus, these reactors, aside from actual electricity production, will contribute little to the indigenous technological development underdeveloped nations. Instead, dependency on foreign suppliers may be increased over that of conventional nuclear projects in these states.

- The Soviet Union also now offers an intermediate sized nuclear reactor (440 megawatts) which is standardized but which is constructed in conventional manner at operating sites. This reactor is already deployed in the Eastern European nations on a wide scale, with orders outstanding in Cuba, Turkey, and Libya.

3. Laser Isotope Separation of Nuclear Fuels

The spread of nuclear weapons has been slowed by the great difficulty of separating "fissile" (or weapon-grade) material from nuclear fuels. So far, only the most advanced industrialized countries have possessed the technological capability to accomplish this separation process using complex, expensive

gaseous diffusion and other techniques.

Now, a new process under development in several industrialized nations may make the separation of nuclear fuels a significantly easier, less costly, and faster process than that of previous technologies. This new process, called Laser Isotope Separation (LIS), [19] uses lasers to separate fissile isotopes from nuclear fuel. Whereas a gaseous diffusion process, for example, involves the use of huge, multi-billion dollar facilities that are impossible to conceal from outside observation, laser isotope separation can be accomplished with relatively small facilities that are easy to conceal and require far less capital to produce.

In the United States, the current administration has considered using this new process (which, by some estimates, is expected to be economically available by the late 1980's) as a means of recovering plutonium from the spent fuel of civilian nuclear power plant wastes for use in the US nuclear weapons programme. Such a policy would further link the civilian and the military aspects of nuclear energy — a link that three decades of policy-makers have sought to downplay.

4. The Dismantling of Nuclear Export Restrictions

Ironically, it is at this very time in the United States that the current administration is slackening restrictions on the movement and use of plutonium both domestically and in the US nuclear export programme. These restrictions were built up during the Carter administration in response to widespread concerns over the rapid spread of nuclear technology around the globe. Other industrialized nations, in fact, did not have these restrictions in the first place. But US policy in the late seventies was based on the hope that other industrialized nations would join the US in outlawing the movement and use of plutonium.

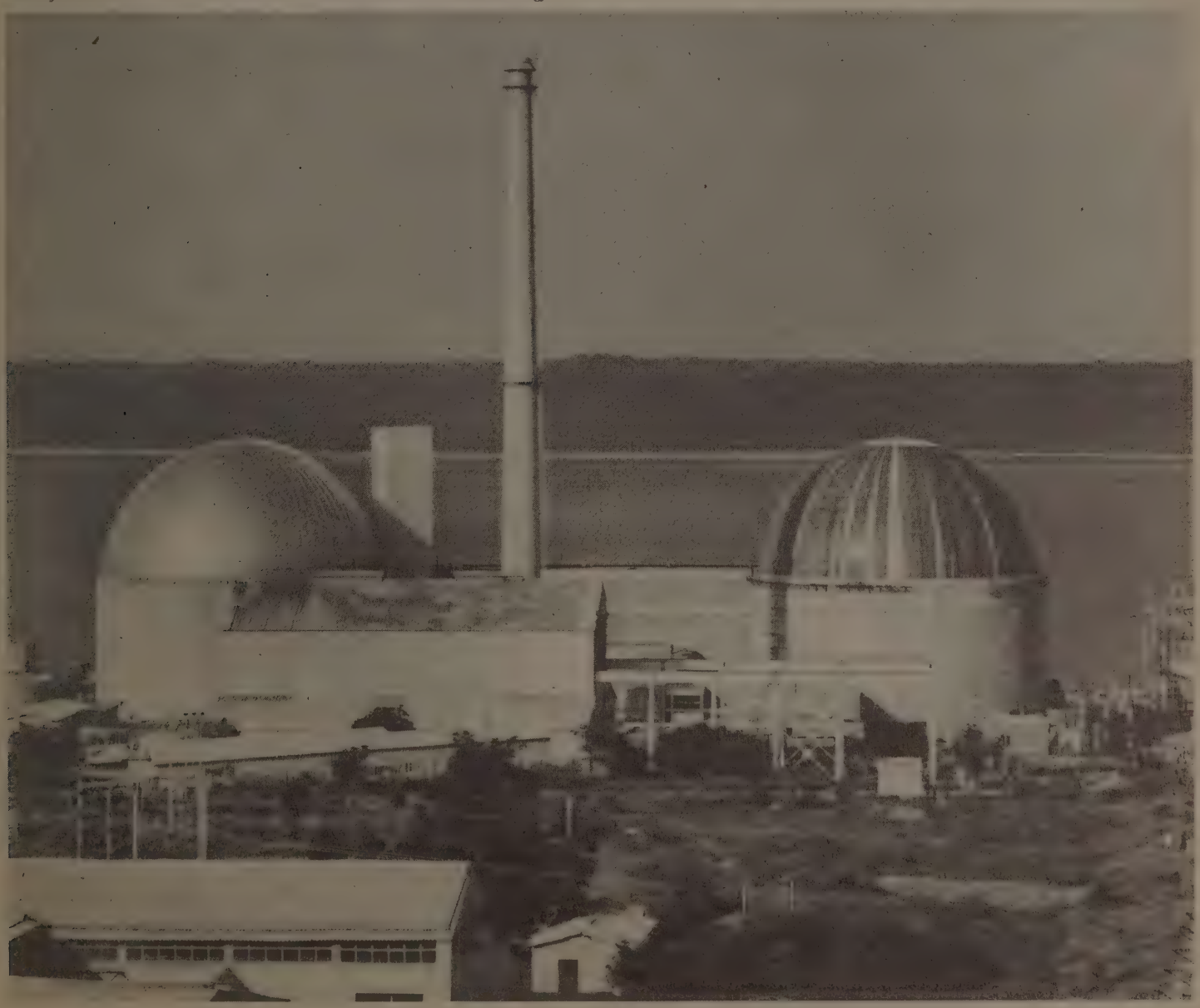
Now, in removing some of the restrictions on nuclear exports adopted by the Carter policies, the current administration hopes to place the US in a stronger competitive position with respect to European rivals-allies for foreign markets.

Some international political instruments have been installed to mitigate the proliferation risk of civilian nuclear power. Recently, the viability of these has been seriously questioned, as the following two sections illustrate.

5. The International Safeguards Systems

Civilian nuclear programmes around the world are now monitored by the International Atomic Energy Agency (IAEA). This agency tracks the material flow of nuclear fuels and equipment between countries and conducts periodic inspections of civilian nuclear facilities in individual countries to ensure that materials are not being diverted from civilian to military programmes.

The Rajasthan Nuclear Power Station in India, based on Canadian, CANDU technology.



The agency's ability to ensure that nuclear energy is used only for peaceful purposes has, of late, been seriously questioned. The lack of confidence in the agency's programme was underscored in June 1981 when Israel, acting on the basis of information claimed to have been obtained covertly, bombed the Osirak nuclear research reactor in Iraq which was under IAEA safeguards. Israel claimed that safeguards applied to this reactor were not adequate, and that Iraq was clandestinely pursuing a nuclear bomb through use of the reactor.

Following this event, the safeguards systems of the IAEA was examined and criticized by many different agencies, including the United Nations, and even personnel within the IAEA itself. Yet, no substantive changes in the agency's programme have been implemented. Regulatory and promotional functions of the IAEA still fall under the same roof. And nations still have the sovereign prerogative to withdraw from agency safeguards at will.

6. Efficiency of the Non-Proliferation Treaty

The 12-year old Non-Proliferation Treaty, long considered a centrepiece of global security, has also recently been subject to strain and criticism by the international community. In the treaty, a bargain was struck between the nuclear suppliers of the industrialized world and the underdeveloped nations. In return for access to civilian nuclear technology, non-nuclear-weapon states promised to allow IAEA safeguards to be applied to all of their civilian nuclear facilities. The bargain also stipulated that if industrialized nations possessing nuclear weapons would agree to pursue nuclear arms control and disarmament, the underdeveloped nations would agree to forego the production of nuclear weapons.

Today, the efficacy of the treaty is tainted by the fact that nations possessing nuclear weapons have not reduced their arsenals. In fact they are strengthening them with new and more sophisticated weapons systems. Further complicating the treaty will be the introduction of small reactors to the international arena. At the time the treaty was formulated most underdeveloped countries were so hindered from pursuing the nuclear option that the bargain lacked substance. Today, however, old economic and technical constraints on nuclear power are slackening for developing nations at the very time when survival of the worldwide nuclear industry depends on securing potentially lucrative markets in the underdeveloped countries. Thus, new tensions between industrialized and underdeveloped nations are sure to arise.

7. Health and Safety Assessments of Nuclear Exports

Since there are currently only few internationally standardized nuclear regulations, it is often upto the individual supplier or purchaser to decide exactly what constitutes a "safe" or an environmentally benign nuclear power plant. [21] This lack of an international regulatory structure allows manufacturers to compromise the standards of their own countries when exporting nuclear power plants to other nations.

8. International Nuclear Fuel Cycle Evaluation

In 1977, the Carter administration in the US commissioned a 66-nation study (the International Nuclear Fuel Cycle Evaluation, or INFCE) of the worldwide prospects for nuclear power and civilian control of the nuclear fuel cycle. The two and one-half year study, completed shortly after the WCC's conference at MIT in 1979, concluded that "effective measures can and should be taken to meet the specific needs of the developing countries in peaceful uses of nuclear energy." This study, it should be noted, did not anticipate the development of small reactors.

The INFCE conference is already being used as a fundamental rationale for the development of exportable small reactors by nuclear manufacturers who claim that they are, in a sense, "duty-bound" to provide the underdeveloped countries with nuclear energy. [22] Thus, the proliferation of nuclear technology will now proceed as if in direct response to prior discrimination against the underdeveloped countries.

Nuclear Power for Whom ?

If recent developments in small reactor technology reach fruition, many underdeveloped nations will have an opportunity to implement nuclear power programmes. Yet, in the foreseeable future, nuclear energy can be used in the underdeveloped world only to supply central-station electricity to national or regional electric grids which serve only a fraction of most nations' populations. Even small reactors cannot be regarded as a decentralized form of energy production.

Electrical distribution, in most nations, does not extend to rural areas where the bulk of national populations reside. Electricity generally serves urban industrialized centres, and even in these areas the distribution is not uniform. The City of Bangkok, for example, which houses about one-ninth of Thailand's people, consumes more than two-thirds of the electricity produced in the country. Yet, many of the residents of Bangkok itself are unconnected to the electric grid because they cannot pay for electricity or for the appliances that use it.

Clearly, there is an increasing need to provide for the energy needs of the urban centres of the underdeveloped countries, including that required for industrial purposes. Within the context of that need, the role of nuclear energy and other energy technologies requires thorough investigation, balanced against a proper understanding of not only the physical functions of energy technologies, but also the broader social and political role. In such an investigation, several issues arise, including :

- the overall costs of nuclear energy versus the costs of alternative methods of meeting energy demand (this does not only mean comparing specific technologies, but including variations in social planning, rational utilization of resources, etc.);
- the optimal allocation and utilization of capital throughout al sectors of society, particularly within urban centres themselves;
- the level of managerial complexity of various technologies;
- the contribution of various energy technologies (and concomitant social processes) to the indigenous technological development of a society;
- the institutional and regulatory structures required for maintaining safe and efficient operations of an energy technology, and the costs of such structures;
- the potential health, environmental and ecological impacts of a given energy technology;
- the degree to which a given energy technology adds or detracts to the goal of a more equitable distribution of social, economic and political power within a society, and within urban centres.

Most of the new developments and issues raised in this report concern the expansion of nuclear energy programmes in the underdeveloped world. Until recently, the nuclear power debate has been largely a concern of the industrialized countries.

Today, however, the spread of nuclear technology to the underdeveloped world seems almost inevitable. Opposition to this spread, despite the potentially serious repercussions mentioned earlier, is likely to be met with counter-opposition from the underdeveloped countries themselves, many of which will claim that to

deny nuclear technology to some countries while others are allowed it is an act of intolerable discrimination.

Thus, if we are truly concerned about recent developments in nuclear energy, we must analyze the nature of this alleged discrimination. In discussing this particular issue, the June, 1982 meeting of the Advisory Group of the Energy for my Neighbour Programme paid equal attention to the **internal** aspects of this discrimination within both underdeveloped and industrialized countries, rather than focus only on the international aspects of this discrimination (i.e., discrimination within countries as well as discrimination between countries). Within this broad framework, the questions were raised : Who exactly will benefit from nuclear power programmes in the underdeveloped world ? Who needs nuclear energy and why is it needed ? In discussing these questions, efforts were made not to restrict discussion to national supply/demand balance sheets, but to move on to the social, political and ideological functions served by nuclear energy, both domestically and internationally.

By focussing on the particular issue of discrimination, we did not intend to exclude the many other issues involving nuclear power that deserve repeated scrutiny and reanalysis. Much of the discussion of these issues, however, is already well documented in prior WCC documents. [23] The issue of discrimination was thought to warrant special attention, since expanding nuclear export programmes in the industrialized world are now being justified on the basis of efforts to avoid discrimination against underdeveloped nations.

Nuclear power, like other complex, capital intensive (usually imported technologies, require programmes and institutions employing highly skilled labour. That labour which is not imported from the industrialized world is often made up of technical workers occupying the highest income groups within societies. Moreover, it is often the case that technical workers, once trained and educated to operate sophisticated imported technologies, leave their societies for more rewarding positions in the industrialized world (a phenomenon known as "brain drain"). It is therefore extremely important that the training of qualified engineers and scientists in the underdeveloped countries be done in ways which will make them capable of applying (if need to be, highly sophisticated) solutions to local problems which are appropriate to the local socio-economic and technical criteria. This issue will have to be dealt with much more seriously by development planners especially in view of the fact that in most underdeveloped countries the number of highly skilled engineers and scientists is limited, and that the energy choices will influence the allocation of skilled labour to differing sectors of society.

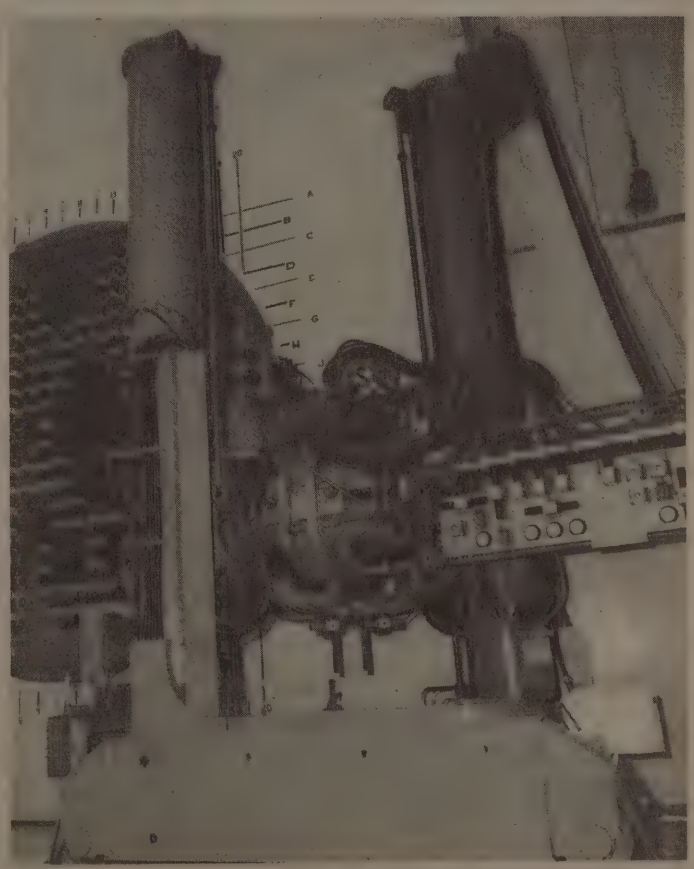
Within this context, nuclear energy technologies and technologies of a similar nature warrant special concern, much as they have in the industrialized world, but perhaps with even more emphasis. It is often the case that those who benefit most from these technological systems are those whose position in society is already most privileged. To the extent that scarce capital and resources (human and material) must be diverted from projects that would assure more equitable distribution of benefits (e.g. decentralized energy sources), nuclear power and technologies of similar nature aggravate the already unequal distribution of political and economic power within underdeveloped countries. It must be emphasized, however, that even the most decentralized energy technologies do not guarantee by themselves less inequalities if the technologies are not accompanied by the necessary social and political controls (i.e., the control by people, whom the technology in question is supposed to serve). Highly complex technologies like nuclear energy, by their centralized nature, however, require substantially greater social control before there is assurance that they will serve the needs of the poor and powerless.

Similarly in the industrialized world, it is often the privileged sector of society that most benefits from the expansion of nuclear power programmes and similar technological programmes to the underdeveloped world. Foreign capital is added to domestic, strengthening stocks and investments in private industry, and paying the salaries of a technological elite. Most national nuclear programmes are subsidized with government tax money, and yet the revenues from complex construction projects in underdeveloped nations are distributed only to private shareholders in many nations. This process, certainly a driving force of many technology transfers, also warrants further study and analysis by the Ecumencial Movement.

The extent to which the powerful in the industrialized world are allied with the powerful segments in the underdeveloped world may be a critical entry point for analysis, and may go far in explaining the nature of "discrimination" between rich and poor that will likely arise as a justification for expanding nuclear power programmes to underdeveloped countries. In many cases, to defend the acquisition of nuclear power by underdeveloped countries in an effort to counter discrimination against the poor is to ignore the equally important, or more important, internal discrimination against the poor in both industrialized nations and underdeveloped nations which, in fact, often prompts the introduction of nuclear technology.

In this context, the military implications of nuclear energy must also be mentioned, since that is a clear example to the point that nuclear technology is used to serve the interests and to increase the power of the rich and the powerful. It has been shown in many studies that civilian nuclear facilities are not the easiest ways to acquire weapons grade nuclear materials. It is, however, also evident that such civilian programmes are the best ways to acquire nuclear technology and knowhow in general, which if need to be could be used for military purposes. Many view the civilian nuclear programme of countries like India, Argentina and South Africa as just the first step toward the achievement of military capability. Nuclear explosions, such as the one by India and the "mysterious" one by South Africa [24] confirm this.

A view of the India-made Fuelling Machine Carriage for Unit-II of the Rajasthan Power Station.



VI. ENERGY ASSISTANCE AND DEVELOPMENT

Background

It is evident that the underdeveloped countries will need substantially increased supplies of energy in order to improve the quality of physical life for their populations. This is especially true for the poorest and most exploited sections of the populations, who at present cannot even satisfy their most basic needs for food, water and firewood. It is becoming apparent that in many cases, it is precisely the lack of fuels which stand in the way of larger production of food and the pumping of more fresh and clean water. Large population increases will further exacerbate these problems.

Development assistance, therefore, has to always take into account the energy dimension of all projects and activities. This will have to include not only issues concerned with the availability of particular fuels, such as oil, firewood or cow dung, but even more importantly with the availability of technologies, with which these fuels can be exploited (e.g., oil exploration rigs, cookers or biogas plants) and which are appropriate to the given socio-political circumstances.

Most people in the underdeveloped countries depend on traditional fuels such as firewood, cow dung and agricultural residues — in short on biomass. [25] This includes most of the rural populations and the urban poor. Due to the prohibitive prices and often the non-availability of commercial fuels, many urban rich, as well as many industries are now turning to the burning of wood and charcoal also. These events, coupled with the large population increases are putting ever growing burdens on these natural, renewable resources which the ecosystems cannot take anymore. The results include deforestation, soil destabilization, flooding, drop in agricultural yields and of course further energy shortages.

In most cases, reserves of biomass or fossil fuels do exist. The problem is not the resource, but access to it either because of overuse (i.e., in the case of forest biomass, where most of the tropical forests are being deforested) or because of the lack of technology to make it a useful energy source (i.e., oil exploitation technology, biogas plants, hydroelectric stations, etc.).

Access to energy, however, is more of a socio-political than just a technical problem. It is one of the basic errors of energy assistance, that by simply implementing a specific technology the desired social result will come about.

Energy development must therefore mean the improvement of the management of existing resources, as well as the increase of the supply of both traditional and commercial sources in ways, which are appropriate to the specific socio-political conditions. Energy technologies should be the tools with which desired socio-political aims can be achieved and not vice versus.

Most energy planners in the underdeveloped countries are now realizing that multiple approaches are necessary. Large centralized energy sources cannot supply hundreds of millions of people in the countryside with cooking fuel as well as with all the necessary energy in agriculture and rural industries. Such strategies would take too long to reach everybody in the rural areas and the costs would at any rate be prohibitive even if fuels to run such centralized sources were available. Small scale, decentralized energy systems are more appropriate for rural energy development.

On the other hand, it is also being realized by the proponents of decentralized, renewable energy options, that given the present state of these technologies, they will not be able to supply large urban-industrial centres, like Bombay or São Paulo, with sufficient energy for some time to come. Given the seriousness of the energy situation careful consideration has to be given to the end-use when deciding which option to take. Energy development therefore should pursue **all** possible options. Where possible preference should be given to renewable energy technologies, which are environmentally sound and encourage self-reliance.

Ways not to Go

As far as the poor, deprived and the oppressed people are concerned, development aid during the first two "development decades" has had mostly negative impacts regarding access to energy. The "modernist" approach has proved to be discriminatory. Clear examples are provided by the effects of the green revolution on the macro level (e.g., the production of energy intensive export crops, enriching the elites while neglecting food crops resulting in malnutrition for the poor) or the distribution of biogas plants at the micro level (e.g., only the relatively rich being able to buy plants, with which they become even richer, thus exacerbating the rich-poor conflict).

Much of the aid has been based on technologies and technological systems from the industrialized countries, with the resulting technologies being more often than not inappropriate for rural development. The transfer of technology should not mean simple transfers of devices from the industrialized to the underdeveloped countries. Instead it should mean the transfer of capabilities, by which technologies appropriate to local conditions could be developed and produced in the receiving countries.

Often aid projects are very profitable for companies (state or private) in the donor country, but are totally inappropriate to the local needs in the receiving country. A good example of this is the export of nuclear plants to underdeveloped countries. While there is no reason why certain programmes could not be profitable, only such projects should be selected which match local needs.

In many cases, technology for the underdeveloped countries implies second rate technology. Just because a technique is simple (e.g., a solar cooker) it does not mean that it will be appropriate for rural development. The same way, just because an electricity generator is based on old technology, it does not mean that it will be appropriate in a country, where no broad technological and industrial infrastructure exists. In this sense, both the establishment (i.e., government and business) and the "appropriate technology" group sponsored development projects largely failed to reach expectations in the past.

"Development Policy"

Government and private aid agencies have distributed hundreds of millions of dollars worth of technologies in various parts of the underdeveloped world, finding that after short times the machines stopped, broke down and soon people were going about their business in the traditional ways, with the beautiful biogas plants rusting away in the villages and the world's most sophisticated rubbish burning plant never being turned on in Lagos, due to the lack of trained personnel. In India, government grants for the construction of biogas plants were used to marry daughters and in Kenya, double walled, thermodynamically efficient cookers are used as flower pots.

Aid, without full participation of the receiver cannot have more effect than for a cancer patient to take pain relievers. It may help for some time, but it does not solve the problem. What it does, however, is make the receiver get used to the drug, make him an addict.

Search for Alternative Approaches

It is important to keep in mind that alternative approaches to energy development although necessary, by themselves will not be able to change the present socio-economic structures for the better. Appropriate energy aid can be **a** factor in improving the human condition, but only if it is **complemented** by others, especially by changes in the social and political environments. In fact, technologies, if not complemented by specific social and political changes may further exacerbate the problem.

A good example would be the Brazilian alcohol programme, [26] which was started originally, to help poor farmers. In the absence of any social control, however, in a few years the programme developed into a multimillion dollar, high technology, and TNC-owned enterprise, not only bypassing the poor farmers, but even robbing them of their land and employment.

Although all sectors of underdeveloped societies need energy assistance, this report deals primarily with the rural sector, since this is the one which is being most neglected by governments and large international aid agencies. [27]

If a project is supposed to improve the situation of a specific group of people, an essential precondition is people's organization and authentic participation. There needs to be a high degree of consensus among the receivers regarding their common goals and objectives. The lesser the degree of social organization the higher is the danger of one person or a small group of people gaining exclusive control and using the new technology against the rest of the people.

In practice, this means that the donors will have to ask a lot of questions before introducing anything. In fact, the donors should be there to **assist** in the most basic sense of this word. The initiative, however, has to come from the receivers.

The WCC, through its various departments, such as the Commission on the Churches' Participation in Development, (CCPD) has been involved in a great deal of community building, awareness building and education programmes. Such programmes should be made use of to facilitate people to look at their energy related problems in a different light.

Churches, as well as other Non-Governmental Organizations (NGOs) will only be successful in propagating new techniques of energy production and utilization, on a large scale, if they are supported by a very dense network of all kinds of scientists, engineers as well as community developers, etc., who have a good understanding of the socio-political conditions in the area of implementation.

It is essential that programmes of energy assistance also include dimensions dealing with the socio-political implications both at the micro as well as the macro level. In other words, energy projects should not only follow technical, but also ethical, social and political rationales.

In order to make the best use of energy assistance, the following general features should be emphasized, whenever possible :

1. **Self-reliance** at local as well as national levels cannot be over-emphasized. It implies that communities and consequently whole nations authentically develop from within, according to their needs and within the limits of their possibilities. Self-reliance does not equal autarchy, and there is a great scope for international cooperation (especially between partners having similar problems) and for international assistance (from rich to poor).

People take pride in, and take much more seriously projects which are the results of their own deliberations, than objects (e.g., windmills, biogas plants, etc.) simply installed by a development agency. Self-reliance is primarily a means toward authentic human development.

Self-reliance also makes sense economically and politically for the people as a whole (but unfortunately not always necessarily for the elite in power). Precious foreign exchange can be saved for purposes for which there are no local alternatives. Local employment can be created, which does not only employ people, but also creates local capabilities and technical infrastructure. Such developments contribute to lesser dependence on foreign suppliers and consequently to lesser external economic and political domination.

2. **The multiplier effect** of increased energy consumption needs to be carefully studied, so that energy assistance may go to those sectors where it can make the most difference. It has been shown that production activities, especially in the fiel of agriculture are the sectors where the marginal utility is the highest for a given increase in energy consumption. Priority should be given to such agricultural uses as fertilizers, where the multiplier effect can be 4-6 fold. [28]

3. **Educational value** of energy assistance projects is perhaps the most important aspect of development aid, according to our ecumenical perspective. There is an almost insatisfiable need for the training of well qualified technicians, scientists, engineers, technology assessors and policy makers, community developers, etc.. Again, the multiplier effect of training one good technician in an underdeveloped country, compared to sending an expatriate from an industrialized country must be evaluated before action. The training of local capability to initiate and carry out energy development projects should be one of the central aims of outside assistance.

4. **Biomass and other renewable energy sources** are already the most common fuels in the underdeveloped world. More efficient management of these precious resources could make very positive impact. In most cases, technologies relying on these tend to be the most appropriate to the socio-economic conditions found in de-centralized rural communities, where 70-90% of the population lives. Traditional techniques should be improved, and based on these new ones should be developed which reflect more the present socio-political and environmental realities. Greater reliance on these energy resources is a necessary condition for self-reliance.

5. **Environmental concerns** are not only concerns of the rich. It is now widely accepted that they are equally important in all countries. Deforestation, soil erosion, flooding, smoke inhalation, blindness are all phenomena which to some extent, if not entirely have energy related causes. The environmental impacts created by energy projects must be assessed. However, one should not be blinded by strict environmental criteria, when the basic needs of

the presently suffering clearly take precedence over the possible needs of future generations.

6. **The economics** of energy projects should not be overlooked if they should ever become viable on their own. Energy systems must be profitable, in every sense of the word, both for the suppliers (e.g., private or government agencies) as well as the users otherwise they will be neither produced nor accepted. Presently, most poor people do not buy fuels — they collect them, for free. Any new technology, if costs money will have to come with appropriate financing schemes (e.g., credits, employment for pay, etc.) so that users may purchase them. Usually, there is excess labour in rural areas, although often seasonal. In such cases labour intensive technologies are more appropriate. In any case, highly capital intensive projects are out of reach for most.

Energy Needs and Supply Options

It would defeat the purpose of this paper if we could give a "blueprint" for rural energy needs and possible supply options on a few pages. It is evident that thorough case studies will have to be done in each situation, whenever an energy or energy related project is initiated, based on the local technical environmental, cultural, social and political criteria. It is possible, however, to describe in a very general way what kinds of energy needs are encountered in most rural communities in the underdeveloped countries. It is also possible to list a few techniques, which have been developed in various parts of the world, which seem to be able to satisfy some of these demands. It must be stressed, however, that some of these techniques may be totally inappropriate in some countries, due to specific local conditions, while some of these needs may not at all be present in other communities.

A. ENERGY NEEDS

1. **Thermal energy, below 100° C**

   a) Water heating for domestic and agro-industrial use.
   b) Domestic heating, including green houses, cattle stalls and homes.
   c) Drying of fruits, seeds and other agricultural products.

2. **Thermal energy, over 100° C**

   a) Domestic cookers and ovens (some cooking such as boiling, is under 100° C).
   b) Rural industrial ovens (e.g., bricks, ceramics, glass and metalwork).

3. **Mechanical energy**

   a) Pumping water for domestic use as well as for irrigation and industry.
   b) Ploughing and other cultivation.
   c) Milling, grinding, stacking and threshing of various agricultural products, such as coffee, cocoa, rice, sugar-cane and maize.
   d) Transportation of people as well as products.

4. **Electrical energy**

   a) Domestic appliances, including communications equipment (e.g., radios, telephones, etc.).
   b) Light for reading.
   c) In specific cases provide mechanical energy for point 3. above.

5. **Energy for refrigeration**

   a) Cold storage of fruits and other foodstuffs.
   b) Air-conditioning in very hot areas.

6. **Agricultural energy**

   a) In the form of fertilizers (both organic and inorganic).
   b) Mechanical energy for pumping and transportation as in 3. above.

B. AVAILABLE TECHNIQUES

1. **Conventional International Combustion Engines (ICEs)** are in use in many rural areas. Their main advantage lies in their high performance, compactness and reliability. They are, however, expensive to purchase and to maintain. They depend on expensive, and often unavailable fuel and cannot in general be manufactured with local technology.

2. **Human and animal power** are traditional energy sources still having a lot of potential in a village environment. They have several distinctive characteristics. For example, animals can reproduce, in contrast to engines which continually deteriorate. animals, however, are also vulnerable to diseases, theft, and loss from other causes. What is needed is more labour-saving tools which will increase their efficiency and performance; these tools should not replace the man or the animal, but rather take better use of them.

3. **Solar energy.** There is currently much interest in this technology, due in part to its supposedly "free" supply. However, it is important to recognize that the overall cost of solar energy is **not** free. The equipment which will utilize solar energy has its costs, which must be amortized over the expected lifespan of the device. In some cases, this cost is actually higher than that of traditional technology. Nevertheless, there are some solar energy technologies which seem to show promise at present :

a) **Solar dryers** are simple, relatively inexpensive, labour intensive and can be constructed mainly with the local materials. Several designs have been developed for drying of grains, fruits, vegetables, meat, fish, tobacco leaves, etc. Most of them have been tested and perform well. Most village dryer units are used only for a short period in each year, during the harvest season. Consequently, if several crops are grown in the same area, which can be dried in the dryer at different times, the usefulness of solar drying units will be increased significantly.

b) **Solar cookers and ovens.** Strictly, technically speaking, solar cookers and ovens have performed well. However, there are serious drawbacks in terms of social acceptance. Firstly, the user must stand in the sun to cook (a practice not usually preferred, especially in the tropics !). Secondly, most solar cookers and ovens work best during the middle of the day, when solar radiation is most intense. However, the main meal of most village people is at night, which results in a time conflict. Thirdly, the simple (and thus low-cost) cookers available can cook only by steaming or baking, but numerous dishes are deep fried. This therefore seriously limits the choice of dishes that can be cooked, a factor which adds to the technology's unacceptability. It is possible to design a solar cooker for frying, but this often means the use of a focussing mirror and sun-tracking mechanism, which drastically increase the cost of the unit. The most promising use of this technology, therefore, seems to be for steaming or baking food, for example rice and meat, a process which needs little attendance on the part of the user.

c) **Other solar devices.** These include the solar hot water heater, which is now commercially available in many countries, the solar refrigeration, solar water pump and solar photovoltaic cell. They are in general too expensive and too complicated for village use. However, one possible exception is the photovoltaic cell, which although is high technology and expensive may have potential. If the cell's price continues to decrease as predicted, its simplicity for use and its reliability may help it to be accepted in a village community. This will be in much the same way as the transistor

radio, which is a high-technology product, usually not locally produced, but widely accepted.

4. **Biogas** is extensively used in China and India. Its main advantage being threefold. It produces a high quality fertilizer as well as a combustible gas. In addition it has a potential of improving hygene by breaking down organic wastes, such as human and animal excreta. Costs have fallen, but the plants are still too expensive for the very poor people. In many areas there are cultural constraints, which cannot be overlooked. In spite of these problems, however, biogas can and in many places already has become very important.

Selling dried cowdung cakes to be used as cooking fuel on the streets of Calcutta.

5. **Biomass** has been used as an energy source since time immemoral, mainly by direct burning. Recent interest has been centred on a few aspects of biomass energy, namely, alcohol production, firewood plantation, and to a lesser extent producer gas. Alcohol can be used as part of a mixture of fuels for internal combustion engines, which seems to be its main intended use. Firewood plantation is, of course, intended for production of firewood for cooking, industrial uses, space heating, etc. Both the alcohol production and firewood plantations have a major advantage over other energy sources in that they do not require the users to change their energy-using habits. This is extremely important in terms of community acceptance. Furthermore, there already exists a certain amount of traditional technology, which only needs improvement, guidance and support to make it operate efficiently.

6. **Wind.** This energy source has also been used since ancient times. However, the problem is that utilization of wind energy is very location-specific, and an unfortunate fact is that good agricultural lands usually do not have much wind. Where it is available, it can be used for water pumping, electricity generation, or for providing mechanical power. Several well-tested designs are available, some being traditional ones which use cheap local materials. Increasing the efficiency and lowering the cost of these wind devices should be priority items in development.

7. **Hydro-power.** As with the case of wind energy, hydro-power utilization is location-specific. It is possible to use hydro-power as an energy source only where there is a sufficient water head and/or water flow. In such locations, several hydro-power devices can be used, such as water wheels, water turbines and hydraulic rams. These are mainly proven technology; the emphasis, therefore, should be on increasing their efficiency and lowering their cost.

8. **Others.** A few more energy devices should be given consideration for use in a village community. These include passive-cooling systems for storage of food and agricultural products, better and more efficient cooking stoves, and geothermal energy for those villages in the vicinity of hot springs. Interest in passive-cooling systems is recently centred on cooling by selective radiation, but serious work on this topic has only begun. More development work is therefore needed. With regard to cooking stoves, a few high-efficiency ones have been developed.

The Role of the World Council of Churches and its Member Churches

Given the WCC's special concern for the improvement of the condition of the poor, deprived and the oppressed, and its general concern for a more just, sustainable and participatory society, by implication the WCC will have to intensify its contribution to improving the global energy situation.

On the one hand, studies of particular problem areas concerning the ethical, social and political aspects of the worldwide energy crisis will have to go on at ecumenical, regional and national levels. In this regard, the existing WCC programme on energy, the Energy for my Neighbour Programme should continue.

The Ecumenical Movement, however, can help in more practical ways as well. In order that this may be possible, the Advisory Group to the WCC programme on energy recommends to the WCC, to its member churches and their related aid and development agencies, that :

1. whenever any development project is initiated, it should also be screened according to energy criteria. This could be done in consultation with the ENP at an ecumenical level, and with local groups and organizations at regional and national levels;

2. they initiate, or support already existing programmes, preferably located in the underdeveloped world, which train well qualified people who will be able to do energy research, development and implementation work on their own. The CCPD and ENP networks, as well as literature produced by these two programmes could be useful in this process;

3. they support and make use of information supplied by agencies where relevant energy and related technologies are being tested *in situ* and constantly upgraded. (The WCC itself should not get involved in the actual testing processes.) Documentation of such testing could be recorded, updated and made widely available by the existing WCC programme on People's Technologies in CCPD;

4. they support biomass and other renewable energy demonstration projects in both industrialized and underdeveloped countries, with special emphasis on projects developed and implemented by people in the underdeveloped countries, in accordance with the general principles described above. The aim of this would be to develop local initiative;

5. they assist the WCC Commission of Inter-Church Aid, Refugee and World Service (CICARWS) and local aid agencies, so that financial support will be forthcoming for Recommendations 1-4.

VII. OTHER IMPORTANT AREAS

In addition to the topics discussed in some detail in Sections II-VI, a number of other important issues were mentioned, in the meeting of the Advisory Group of the Energy for my Neighbour Programme, which require attention by the Ecumenical Movement.

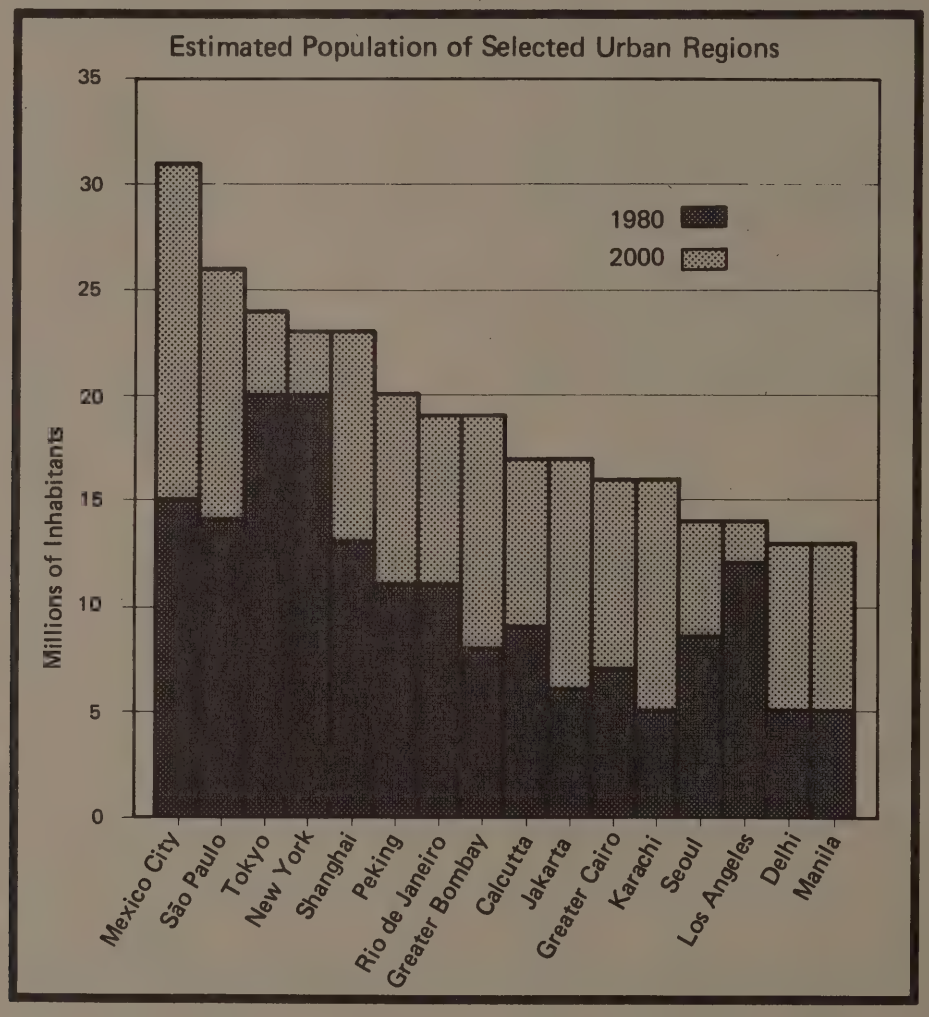
Urbanization

The world's population is increasing at the rate of 80 million people a year, and the numbers living in cities of over 100,000 by as much as 50 million per year. This is particularly a problem in some urban megalopolises in the underdeveloped world, where prime agricultural land is being lost to urban industrial sprawl and land speculation at very high rates. Such rapid urbanization multiplies the demand on energy resources. Quite apart from the need for increased food production from diminishing areas of arable land, there are inherent energy needs of the growing urban population itself for transport, industry, domestic energy and entertainment.

Whereas in the industrialized countries money can be and is invested in energy conservation programmes, reducing somewhat the per capita demand for energy, this is very difficult if not impossible, for the poor of the world whether they live in Paris or Lima. In any case, the average energy consumption of the urbanized poor is so small compared to that of the rich that there is little possibility of physically reducing energy consumption.

The Displacement of Food Crops by Energy Crops

This is a phenomenon which has already been occurring and is likely to increase in significance with ever greater rapidity. Although no defined correlation is known, there is the potentially related fact that despite the worldwide over-production of sugar various agribusinesses are vigorously promoting the establishment of complete irrigated sugar-cane plantations in Africa, and similar trends are reported from other areas. Already, the EEC is one of the world's largest sugar producer, thus undermining the economy of traditional sugar exporters like Mauritius or the Caribbean countries.



Since urban areas are increasingly dependent on traditional energy sources from the rural areas (e.g., charcoal and wood) it is clear that an improvement in the urban-industrial energy supply (e.g., increased availability of petroleum, coal or hydroelectricity) would also result in an easing of pressures on the rural traditional energy supplies. Yet too much relative amelioration of the urban situation will probably lead to further rural-to-urban migration, which will exacerbate the problem. The finding of the relative balance between approaches for rural and urban energy development is thus a crucial matter.

It seems likely and reasonable to assume that the existence of this situation will encourage the development of ethanol producing industries for fuel transport and other urban requirements for those who can afford this new fuel. This will certainly in turn create additional demands for sugar production at the further expense of food crops.

As commercial fuels, especially liquid hydrocarbons become increasingly scarce, it is expected that more and more arable land will be used for the production of energy from sugarcane, grains,

trees and other biomass possibilities. Although theoretically, there is sufficient arable land available on a global scale to provide sufficient food and biomass for our needs, in practice this will only happen if there will be appropriate social controls on those producing these various agricultural commodities. Present methods of industrial biomass production, such as the case of sugar-cane for alcohol in Brazil, show that good agricultural land which had been producing food crops is very often sacrificed for energy crops because that has higher returns on the international energy markets. Given the widespread existence of hunger world-wide, further drops in food production could be disastrous. There is more than sufficient reason to justify the examination of this situation to try and determine the extent of the existing and even more the future risk to food production by the increased production of fuel crops at the expense of food crops.

Energy Inputs into Food Production

The increasing industrialization of food production in the industrialized countries has resulted in vastly increased energy use in the food-producing systems. The agro-chemicals are derived from oil and gas. All the other inputs into food production, processing, packing and transport of food, require fuels, in ever increasing amounts. These energy consuming systems of food production are themselves exported to energy deficient non-industrialized countries, and while initially often hailed as being the miracles that will solve these countries' food problems, are quickly found to be irrelevant, unstable — and highly expensive in energy. It is open to question whether or not the world agricultural industry, and particularly the world's agricultural research industry, has fully appreciated these facts in setting its objectives for present and future research.

ENERGY COST OF COMMON GOODS

How much energy is needed	Oil equivalent in grams
To build a 100 square metre house	10,000,000
To heat such a house for a year	2,000,000
To produce a 1,000 kg car	1,300,000
To run such a car for 12,000 km a year	1,300,000
To prepare meals for a four person family a year	200,000
To make a bathroom sink	10,000
To produce 1 kg of synthetic cloth	5,000
To get 1 kg of fresh fish from the sea to home	1,200
To produce 1 kg of paper	500
To grow a lettuce in winter in the Paris region	400
To produce 1 kg of sugar	400

Technically speaking, there are some new developments in the food and agricultural industry, which could be beneficial from the point of view of energy efficiency and increased food production. These include new, genetically engineered grain varieties which could be grown with substantially reduced irrigation and fertilizer needs, resulting in smaller energy inputs to agriculture as a whole. These techniques, however, are very new (some still in the laboratory stage) and their overall environmental and socio-political impacts have not yet been sufficiently studied. Especially important subjects for study before wide-scale implementation will have to include the impact on genetic variety and ownership of seeds.

An improved traditional cooker for training and demonstration purposes at the YMCA of Chiang Mai, Thailand.

The Availability of Commercial Fossil Fuels

It is highly probable that there exist considerable reserves of crude oil and natural gas in many areas in the world, especially in places where not a great deal of exploration has taken place. Although it is unlikely that huge oil finds, such as the Alaska fields will be found, smaller deposits for example on the East African coast, could make countries like Kenya and Tanzania self sufficient in oil — improving substantially their economic situation. The technology and the finances to carry out oil exploration in order to develop much of these reserves, however, lie with the major oil companies, and thus it is them who will decide whether they should or should not explore and pump in a specific area, depending on their own interest. It would be extremely important to find ways in which the interests of these oil companies could be made to coincide with those of the poor, presently oil importing underdeveloped countries. In this connection, the use of World Bank funds to subsidize oil exploration is one step in the right direction.

Given the fact that an average North American uses over 100 times as much commercial energy as an average African it is clear that small reductions in energy consumption by people in the industrialized countries could in principle result in large increases in the availability of those fuels for users in the underdeveloped world. Many industrialized countries have already reduced energy consumption a few percent due to the energy "crunch" at the end of the 1970s. This is commendable, but such decreases should be done permanently and implemented as **deliberate policy**. In order for this to happen, it is important to mention the necessity to keep the oil price high in the industrialized countries.

In countries in which a socialist approach to energy supply and use has been attempted, such as China, the relatively improved position of the poor *vis-à-vis* fuel poverty is dramatic when compared to those countries in which the market place is allowed free reign. Fuel poverty as a measure of oppression and degradation of life is not restricted to the underdeveloped countries. They can be seen in such wildly different countries as India, USA and Scotland, just to name a few.

VIII. THE WCC PROGRAMME ON ENERGY

The past nine years of activity in the area of energy have provided the Ecumenical Movement with a sound foundation, enabling it to work together with lay people, scientists, engineers and theologians on these problems. A brief history of these activities can be found in the Appendix at the end of this report. (See page) Although study and reflection have always been the central elements of these activities, there have also been many, more practically oriented projects as well, such as the creation of the Energy for my Neighbour Programme in 1976.

In view of the results which have already been achieved and the investments of time and money which have been made, we believe that it would be highly desirable for the WCC to continue energy related work, either in the Sub-unit on Church and Society, as at present, or elsewhere in the structure of the WCC. The ground work has been laid for urgently needed future work. The investment has already borne fruits in the process of bringing people with different experiences together and in encouraging local church and other groups to undertake energy conservation, educational and other practical programmes in their own locations, supplying them with information, guidance and contacts from other places. In this context, the creation of the "Energy for my Neighbour Network" has provided very valuable.

There is great need to continue to have an ecumenical programme after the Vancouver Assembly which could coordinate the energy related work of the churches. As the preceeding pages of this report also show, there are many unresolved problems, where further study and reflection is necessary. Such a programme of work will require the total commitment by the Ecumenical Movement to the importance of this subject. Consequently, the WCC programme on energy will require the confirmation of this programme of work as mandate for the future. Such a mandate will be firmly grounded on the biblical concepts of stewardship of resources, justice for the poor and oppressed and responsibility for the future.

In view of the above, the Advisory Group requests the Energy for my Neighbour Programme to continue its activities until the Vancouver Assembly. During this period, the programme would :

1. Prepare materials and gather information for use by the Assembly, which will include audio-visual materials as well as the publication of :
   i) an issue of *Anticipation* devoted to energy issues, including this report of the Advisory Group;
   ii) a popular small booklet to be used especially by congregations about the results of the Third World Energy Enquiry;
   iii) the book being prepared by the staff of the Energy for my Neighbour Programme, about more just and sustainable energy policies.
2. With the help of the above publications continue the development and the support of the activities of the network of churches and other organizations working in the area of energy, so that this may provide a feedback to the Assembly.
3. Prepare the ground for future ecumenical work on energy for the period after the Vancouver Assembly, as described below.

The Advisory Group also recommends to the WCC, that it continue energy related work after the Vancouver Assembly, either in its present form, the Energy for my Neighbour Programme, or in some other sub-unit. Future work should include the following important areas :

1. The programme of regional consultations needs to be continued with two gatherings in Africa and one each in the Middle East and the Pacific. Consideration needs to be given to the possibility of follow-up consultation in the same regions as before, although in different locations, to maintain the momentum of contact, inter-change of information directly between the participants and the accumulation of practical experience for use by others.
2. A number of important subject areas have been identified in this report, which will require further ecumenical study and action. Given the rapidly changing nature of the global energy situation, it is expected that by the time the Assembly takes place there will be other issues also which will have to be considered.
3. The Energy for my Neighbour network should be broadened as much as possible. The network should be used extensively to exchange information between different regions. In this context it would be desirable to publish a regular journal for the network.
4. The programme should cooperate with other WCC units and agencies working in the areas of development assistance, as described in the specific recommendations for energy aid. (Section VI, pages 18-21)

These studies and activities will be important parts of the tasks of continuing to generate deepening awareness of the fundamental importance of energy to all aspects of society's life and existence. As part of this task the Programme must cooperate with the churches and the WCC agencies involved in direct programme support and action. This will ensure that, in the appraisal, monitoring and evaluation of such action schemes, the changing demands, needs and resources of energy to the community are fully examined as an unavoidable and essential part of the whole programme.

Some members of the regional consultation in Thailand.

IX. APPENDIX

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B. HISTORY OF ECUMENICAL ACTIVITY IN THE AREA OF ENERGY, 1974-1981

The first, so-called energy crisis hit the industrialized world at the end of 1973, when the Organization of Arab Petroleum Exporting Countries, OAPEC, decided suddenly to limit its production of crude oil destined for the international markets. Although the actual reduction of oil on these markets was very small, the psychological result was devastating. Suddenly the world realized what it should have been aware of long before : the oil supplies were not infinite and most of the world's oil — the most important source of energy — came from politically perhaps the most unstable part of the world. The "energy crisis" soon became one of the most important subjects discussed by politicians, journalists and the populations at large. The churches and the ecumenical movement as a whole were also obliged to take up this important topic. Since it involved basic issues of modern technologically organized society and the debate about economic and ecological limits to growth the topic soon appeared on the agenda of Church and Society.

BUCHAREST, Rumania (1974)

The world conference was organized by the WCC in Bucharest on the theme Science and Technology for Human Development. [29] This conference was the result of five years of preparatory work within the WCC Study Programme on the Future of Man and Society in a World of Science Based Technology. At this meeting the churches were inevitably drawn into the growing controversy concerning the different energy options available, and especially concerning nuclear energy. Five major areas were selected as important concerns for the churches to follow up on :

- the importance of studying the ethical components of the different energy options and energy policies, especially the rapid development of nuclear energy;
- the importance of wide public debates on the choice of different energy options;
- the need to set up an "International Resource Bank" to help commercial energy development in the developing countries;
- the need for energy conservation, more rational energy use in order to reduce per capita energy consumption levels in those countries where too much is used; and
- the need to develop alternative energy sources based on solar and other renewable forms.

These areas of concern had a decisive impact on the following seven years of ecumenical work on energy. The Sub-unit on Church and Society was specifically asked to initiate an ecumenical study on the "major moral, economic, social and scientific implications of the extension of atomic energy plants in the world". This recommendation was forwarded to the Central Committee in 1974 which gave its approval. [30]

THE SIGTUNA HEARING (1975)

In order to clarify these issues, Church and Society convened an Ecumenical Hearing on Nuclear Energy, in Sigtuna, Sweden. [31] About 35 energy experts presented many different positions concerning the ethical and social aspects of the nuclear energy option. The group brought up a number of important issues such as the technological dependency of the less industrialized countries on the nuclear suppliers or the relationship between nuclear energy and nuclear arms if the development of nuclear energy continued. It was also realized that nuclear energy, could in principle supply large amounts of energy in the world, which was necessary for the development efforts. The group did not feel in the position of being able to put forward categorical recommendations. "... (We do not) feel justified in either entirely rejecting, nor in wholeheartedly recommending large scale use of nuclear energy".

The Sigtuna Hearing was not able to provide the "answer" that some were hoping for in judging nuclear energy. Instead it provided the churches with a number of interesting questions to the different positions. The report of the hearing was published in *Anticipation* [32] as well as in a book, entitled *Facing Nuclear Power*. [33] These were widely circulated within the church and within secular and technical circles also. The report was eventually translated into French, German, Spanish and Italian. It was perhaps as a result of this report that many so-called "energy experts" began to take the views of the WCC seriously. If the report was not welcomed by more people this was perhaps due to its relative "neutrality" and neither the extreme pro- nor the extreme anti-nuclear groups accepted it.

The results of the Bucharest World Conference and of the Sigtuna Hearing were presented to the WCC Assembly, in Nairobi in 1975. [34] By this time it became evident that it was not possible to discuss the pros and cons of nuclear energy, without dealing with the energy issue as a whole. Neither was it possible to find any simple ethical reasons for the acceptance or the rejection of Nuclear energy. The issue had to be discussed further in the context of looking at all the energy options available. This showed the need for comparative studies of the different energy options available, especially insofar as their social and ethical aspects were concerned.

THE GLION CONSULTATION (1976)

This search for a more holistic approach to the energy problem was discussed during the meeting of the Church and Society Working Committee in Glion, Switzerland in May 1976, attended by several energy consultants. [35] These discussions produced the idea of "Energy for a Just and Sustainable Society". Previously most of the discussions on energy concerned the industrialized countries, or some of the urban, industrial regions of the developing countries. At the Glion meeting the energy crisis in the developing countries emerged as a key issue. The group became more conscious of the extreme seriousness of the energy situation in many developing countries, where dwindling supplies of fire-wood, increased populations and prohibitive prices for petroleum and other commercial energy products (including of course chemical fertilizers) were not only creating inconveniences (as in the industrialized countries) but resulting in the inability of many people to even cook their daily food requirements or to irrigate their lands.

As a result, the Glion meeting mandated Church and Society to create the **Energy for my Neighbour Programme (ENP)** — an action programme, through which it was hoped that the ecumenical movement could help directly the energy situation in the countries most in need. The programme was expected to make possible a number of regional consultations on energy issues in the developing countries, to find out more about "the energy policies and the responsibility of the churches" there. The ENP was also supposed to help directly by transferring financial resources as well as technical know-how to those in need from the richer countries in North America and Europe. The ENP was also mandated to conduct an awareness raising programme about the need to conserve energy and about the need for simpler life styles in the industrialized countries. A programme manifesto was written by the late Dr. Keith Roby of Australia, [36] which has gone through two printings as well as translations into German, Dutch and Swedish. The idea was very well received and in many churches the ENP manifesto became the cornerstone energy activity. [37] A few practical projects were also initiated in the developing countries, but due to lack of full time staff the ENP had to be suspended after the summer of 1978.

The Glion consultations also recommended a continuation of the study of "Energy Planning in a Christian Context" by concentrating the work of Church and Society in three major areas in addition to the concerns of the ENP :

- to continue the ecumenical debate on nuclear energy;
- to initiate ecumenical investigations into the other alternatives for possible energy supply especially the solar options; and
- to continue to communicate the results of the ecumenical work on energy to secular agencies, such as the International Atomic Energy Agency.

THE SALZBURG CONFERENCE (1977)

The United Nations sponsored an "International Conference on Nuclear Power and its Fuel Cycle" in Salzburg, Austria where the WCC was officially invited to submit a paper on the ethical issues and the public acceptance of nuclear power. [38] This contribution became one of the three presentations in a plenary session on Nuclear Power and Public Opinion, which the WCC was also invited to chair. The position of the WCC presented at this meeting had been endorsed by the Central Committee and stressed five major points :

1) Nuclear energy offers the potential of providing a large part of the world's energy needs, counterbalanced by some exceptional risks.
2) The maturity of the nuclear energy system is not yet such as to justify large-scale, or unlimited applications.
3) The right of access of all nations to nuclear technology must be recognized.
4) The issues of access and security involve the collective responsibility of all nations which needs to be assessed anew and administered through the IAEA.
5) Public confidence in the use of nuclear energy, seriously shaken in recent years, can be revived only by the widest possible public discussion of the technical options and of the value judgements underlying present patterns of energy consumption.

By the time the reports of the Glion meeting and the Salzburg conference were reported to the Central Committee in 1977, [39] the nuclear debate in most countries (in the churches as well as in the secular world) became extremely polarized and emotional. In view of this the Central Committee has asked Church and Society to organize an ecumenical consultation on Nuclear Energy in preparation to the 1979 Conference on Faith, Science and the Future, with an attempt to conduct a balanced (i.e., pro and anti nuclear positions) sane and informned discussion of activities relating to the whole of the nuclear fuel cycle in the context of "world energy needs and possible resources, and in light also of the concern for a Just, Participatory and Sustainable Society, with special reference to the problems associated with the introduction of the Breeder Technology."

THE BOSSEY CONSULTATION (1978)

The consultation was convened at the Ecumenical Institute in Bossey, near Geneva with the participation of 60 energy experts, church leaders and theologians, representing a wide variety of opinion, including those strongly opposed and those substantially in favour of nuclear energy. [40] Correspondingly no attempt was made to reach a consensus or to compromise in any way the views of any participants. The meeting became often polarized between the "pro and the anti-nukes", reflecting very well the polarization of the secular debate as well. The ideas developed at the consultation can be summarized as follows.

i) The nuclear debate cannot be addressed, in an absolutist sense, without consideration of other energy options, including especially energy conservation and the possibility of technologically less complicated societies. In this respect, the issue is for many governments and peoples not as clearcut ethically, as is for example that of racism.
ii) More specifically, energy consumption and more rational use of energy deserve much more attention.
iii) Most of the nuclear debate is but symptomatic of a much deeper societal debate about more technology or less, about centralized versus decentralized, appropriate (versus inappropriate ?) with many groups defining these terms to suit their own social aims.
iv) No grounds exist for **rejecting** nuclear power categorically. On the other hand, it cannot be **accepted** categorically; it is a conditional good, subject to reasoned acceptance under some circumstances and subject to reasoned rejection in others. Even where accepted there may be a point when we may have to say, "Thus far and no further".

The formulation of the ecumenical position on nuclear energy in this manner was found to be useful by many but was rejected by extremists both pro and contra.

THE MIT CONFERENCE (1979) [41]

In March 1979, just four months before the World Conference on Faith, Science and the Future held at the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts, USA, the largest accident in the published history of civilian nuclear programmes occurred at Harrisburg, Pennsylvania. Nuclear energy became again the top agenda for the mass media; popular pressure groups and for the public at large. Consequently, not only for the energy section but perhaps for the whole conference the nuclear energy question became the most popular item. The section worked out after a great deal of deliberations a set of ecumenical guidelines for the churches and for the governments embodying the ecumenical concerns for more just, sustainable and participatory societies developed during five years of activity in the area of energy. The emphasis of these guidelines was exactly on points 2 and 3 of the summary of the Bossey report (see above). The stress was laid on alternative sources, conservation and models of participation in decisions concerning energy. Substantial pleas were made to churches and to their governments to support financially and otherwise research and development in alternative energy sources, worldwide.

During the plenary debate of the report of the energy section a motion for a nuclear moratorium was introduced. After long and heated debates the moratorium was passed by a 3:1 majority and was inserted as one of the guidelines already mentioned. The guidelines are as follows :

"A. We recommend to the churches that they :
1. give high priority to the development of strategies for full participation in discussions and decisions regarding the energy issues within their membership, in ecumenical councils and in public;
2. insist that such participation include all classes and groups of the population with full access to relevant information and real involvement in the discussions and decisions through fair and open procedures;
3. arouse concern and conscience regarding energy decisions with specific consideration for the responsibility people bear as citizens, consumers and workers in all aspects of the energy sector;
4. identify ethical criteria by which the social impacts of energy technologies must be assessed and insist that in setting energy policy such criteria be given equal weight alongside technical and economic factors;
5. identify and utilize members with special knowledge and responsibility in the energy field who can help one another and others to be equipped for informed participation;

6. involve such experts, along with those who have insight in the theological and ethical issues, in equipping church members for participation in critical and informed deliberations and decisions;
7. develop a climate of trust and critical self-awareness in which biases can be acknowledged and corrected, differences of opinion and conviction can be faced and conflicts be dealt with, thus facilitating a continuing programme of education, participation and choice;
8. develop education materials about the energy issue for different levels of church life which give people a chance to acquaint themselves with the discussion thus far, enter a process of honest and open dialogue and so make up their own minds about opinions to be chosen and decisions to be made;
9. engage in a constructive and critical analysis of the national and international energy policies of their own countries, engage wherever possible in open discussion with their governments about these policies and keep each other informed of both progress and problems in these efforts;
10. engage with people at the local level in projects which enable them personally and together to experiment with a life-style which makes appropriate use of the available energy sources;
11. endorse, promote, and support the use of the WCC "Energy for my Neighbour" programme through their agencies and congregations.

B. We recommend to all national governments that they :

1. study the actual use of all forms of energy in their countries and not only the consumption of commercially traded fuels;
2. base the forecasts of future energy demand on the real needs for different forms of energy in the different sectors, rather than on extrapolation from aggregates of past fuel consumption;
3. provide incentives for the most rapid possible transition to the just, rational and efficient matching of energy sources to energy needs;
4. ensure that scarce resources of capital and skills are allocated in the first instance to the development of systems that will, as soon as possible, efficiently provide energy in the forms really needed from renewable sources;
5. mitigate any severe injustices between different sections of the population which may develop during the transition to efficient and renewable energy systems;
6. limit the growth in combustion of fossil fuels as much as possible, using these fuels, especially coal, as bridging fuels in the transition to renewable energy sources over the medium and long term;
7. meanwhile, use existing nuclear power plants only to the extent, for the purposes, and for the time, that there is no better alternative;
8. immediately introduce a moratorium on the construction of all new nuclear power plants for a period of five years; the purpose of this moratorium is to encourage and enable wide participation in a public debate on the risks, costs and benefits of nuclear energy in all countries directly concerned;
9. not reprocess spent nuclear fuel to extract fissile material such as plutonium — except for separation of small quantities for research and medical applications — and not construct plutonium-fuelled reactors;
10. devise short-, medium- and long-term national energy strategies designed to achieve these objectives and which are mutually compatible;
11. at all stages of the devising and carrying out of such strategies, keep people fully and honestly informed, and encourage the widest possible public participation through fair and open procedures;
12. cooperate with other governments in order to ensure that :
    a. rates of consumption of the world's remaining non-renewable fuels are reduced as quickly as possible;
    b. injustices between countries caused by the unequal distribution of the fuels over the earth's surface and by market mechanisms are mitigated through international agreement;
    c. pollution of the environment by excess carbon dioxide, radioactivity and other by-products of the consumption of fuel is substantially researched and kept to the minimum that is technically feasible and ecologically sustainable;
    d. all countries move, with all possible speed, towards the efficient use of energy from renewable sources;
    e. the trend to destruction of the earth's forests be reversed;
    f. there is international support to aid the autonomous capacity of developing countries for energy research and development and for self-reliant energy projects in the poorer areas of the world."

Although the most publicized issue of the energy debate at MIT was the issue of nuclear energy, the MIT conference was the first ecumenical meeting at which discussions of a truly global and overall energy policy took place. There is a great deal of discussion concerning alternative energy sources, new life styles, issues of participation and of sustainability in the report of the conference which was often missed by the journalists reporting the event. Although there were a number of excellent participants from the Third World, they were mostly based in the urban or industrial centres of these countries and were unable to clarify issues concerning the rural energy situation, which effects most of the population of the Third World. Therefore most of the discussion about energy went along lines favouring the Western way of thinking and the recommendations reflected well ways in which Western people are able to influence their governments. Popular moratoria and wide public debates are the privilege of only a very small proportion of the world's population, and consequently the moratorium recommendation was not found very useful by many Third World participants.

THE THIRD WORLD ENERGY ENQUIRY (1980-82)

Already at the MIT conference the need arose for a more substantial study of the ethical, social and political implications of different paths to energy development in the countries of the Third World. This idea was not new, since the ENP has already been given a mandate in 1976 (See page 26) to hold regional consultations in the developing countries. The 1980 working committee renewed this mandate.

First the staff travelled a great deal in Asia and in Latin America to identify people, churches and organizations who would eventually be able to take part in the enquiry. The original aim was to hold at least one regional consultation in each main region of Asia, Africa, Latin America and the Middle East. Unfortunately due to the limited time allowed by the Central Committee, only the regions of Asia and Latin America could be covered during the time available.

In March 1981 two consultations were held in Asia. [42] The first in Madras, India for about 30 participants from India, Sri Lanka and Bangladesh. Shortly after that a second meeting took place in Chiang Mai, Thailand where about 25 participants gathered from Burma, Thailand, Indonesia and the Philippines.

At the end of October, the last consultation in this series was convened in Lima, Peru, [43] where over 30 participants came from

all over Latin America to discuss the theme "Towards more Just, Participatory and Sustainable Energy Policies for Development." At all these meetings it was possible to invite people representing technical experts in energy development, community organizers, government representatives, church members and leaders as well as representatives of the Roman Catholic churches and of other faiths, such as Muslims, Hindus and Buddhists.

The three consultations have considerably enriched our ecumenical thought on energy matters. On the one hand we have now a much better picture of what the energy crisis means for most people in the Third World. On the other hand these consultations have helped a great deal in understanding what the underlying ethical, social and political reasons are for underdevelopment in the energy sector. ■

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THE UNITED NATIONS PUTS RENEWABLES ON THE GLOBAL ENERGY AGENDA

*David Gosling**

The United Nations August, 1981 Conference on the global energy crisis achieved several major goals. It put renewable energy sources such as biomass, wind and solar energy on the international political agenda, established the need for more flexible aid packages than the ones traditionally administered by UN agencies, and confronted the five thousand delegates with the desperate urgency of the underdeveloped world's fuelwood crisis. Non-governmental organizations (NGOs), including the World Council of Churches, played a more substantial role in lobbying national delegations and the Conference as a whole than at any previous major UN gathering, and the presence of four heads of State, including Indira Gandhi and Pierre Trudeau, gave considerable impetus to the proceedings.

The industrialized countries, in particular the USA and Great Britain (speaking on behalf of the European Community) were opposed to the creation of an institutional mechanism within the United Nations to coordinate, monitor and supervise the implementation of the agreed Nairobi Plan of Action (NPA). A compromise was reached whereby an Interim Committee within existing UN structures (and therefore less responsive to the influence of the underdeveloped countries) was established with a mandate to report to the 1982 UN Assembly via the Economic and Social Council (ECOSOC) — described by the US NGOs who bitterly opposed their government's stance as "a closed membership club serving the interests of the industrialized countries." The World Bank and several industrialized countries agreed to allocate funds to ease the fuel crisis in the underdeveloped world, though it was not clear what proportion of these were contained within previously agreed budgets. The Conference, which took place from August 10-21 in Nairobi's ultra-modern Kenyatta Center was a colourful and extravagant epic which included such unexpected events as a march for firewood initiated by the Kenya NGOs.

The following sections will attempt to analyze the issues underlying the Conference and to summarize the positions adopted by the leading delegations. The contribution by the World Council of Churches will be summarized and considered in the light of other positions such as the Brandt proposals currently advocated by church groups.

LATENT ECONOMIC AND POLITICAL FACTORS

Many of the conflicts which manifested themselves as the conference proceeded were the result of tensions which have existed for at least a decade. The 1981 Conference on New and Renewable Energy Sources (UNERG) should be seen within the context of at least a decade of conferences which preceeded it, and in particular the United Nations Conference on the Human Environment held in Stockholm in 1972.

The Stockholm Conference effectively set up the UN Environment Programme (UNEP) in Nairobi — the first UN agency in a Third World country. A succession of conferences on food, population, human settlements and other so-called environmental issues (including women, for some curious reason !) culminated in 1979 in the UN Conference on Science and Technology for Development — a monumental waste of time and money.

UNERG's beginnings were inauspicious. For a start nobody knew what to call it. UN Energy Conference (UNEC) was politically unacceptable to a number of countries. UN Conference on New and Renewable Sources of Energy could easily yield the all too pronounceable acronym UNCNARSE. UNERG, based on the fundamental unit of energy (erg), was eventually agreed. The Conference's brief was "to promote the development and utilisation of new and renewable sources of energy with a view to contributing to satisfaction of overall energy requirements, especially those of developing countries..."

Initial preparations were desultory. Late 1980 a number of misunderstandings led to the resignation of the Conference Secretary and to the appointment of the dynamic Uruguayan economist, Enrique Iglesias as his successor. By March 1981 eight technical panels had submitted their reports on biomass, solar energy, wind and hydropower, fuelwood and charcoal, geothermal and ocean energy, oil shale and tar sands. These reports highlighted immediately applicable technologies, the main medium term (10-20 years) constraints limiting their utilization, and the best ways of overcoming them.

In addition to the eight technical panels dealing with specific new and renewable energy sources, groups of experts submitted reports on six major issues common to all energy sources. These were financing, information flow, research and development and the transfer of technology, education and training, rural energy (including energy in agriculture), and industrial issues such as energy for transport. By March 1981 a Synthesis Report drew on the recommendations of the various groups had emerged, and was subjected to a wide range of critiques. Many NGOs, including a working group at the University of Sussex supported by the Canadian-based I.D.R.C., felt that the Report overemphasized energy supply to the detriment of specific energy needs in different situations (e.g. between developed and developing countries, urban and rural areas, etc.). It was also felt that insufficient attention was paid to differences between technical and non-technical solutions to energy problems. These imbalances were apparent throughout the Conference, and some delegations drew attention to them.

These technical preparations (which were also conducted on a regional basis) though important, must be set against the background of the economic and political realities of the last decade. Economically and technologically the underdeveloped countries (predominantly in the South, and including OPEC) are highly dependent on industrialized nations such as the USA, Japan, EEC member countries, Switzerland and the Scandinavian countries. Ever since the 1974 special session of the United Nations at which underdeveloped countries made an impassioned plea for a New International Economic Order (NIEO), the transfer of technology from the North to the increasingly impoverished South has been increasingly seen as a major obstacle to global cooperation and development.

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New and renewable energy technologies will ultimately and for a variety of reasons have their greatest potential in the Third World. But 90% of the world's scientists live in the developed North, and technology is a major export. A handful of developing countries such as India, Brazil, Mexico and Malaysia, possess sufficient technological infrastructure to innovate and manufacture their own hardware, but most must purchase their technology from transnational corporations which make vast profits in the process.

The transnationals also control the marketing of raw materials from the Third World, and set international prices in accordance with levels of demand in the North where consumption is greatest. Falling prices caused by higher productivity or a range of arbitrary factors can cause dramatic falls in living standards in the Third World and wholesale unemployment.

Some Third World countries try to escape from their global economic predicament by building up technological and manufacturing infrastructures. To do this they obtain loans from among others, the World Bank and its affiliates. But the World Bank, which together with the International Monetary Fund (IMF), was set up at the end of the Second World War at the Bretton Woods Conference, is dominated by the industrialized North. Thus, for example, the UK has more voting power on the IMF than China, India, Pakistan and Bangladesh put together!

This pattern of economic and political dominance by the North is to be found in many if not most international agencies, and it explains why the "Group of 77" were reluctant to leave the execution of the NPA to an existing UN body. It also throws into perspective the US view that market forces will stimulate the private sector to develop renewables. All this means is that the present unjust system of economic and technological exploitation will continue to perpetuate itself. The "market forces" to which the North Americans and their supporters refer are primarily in the hands of the transnationals, and although there are certain things that the transnationals do well, they are unlikely at present to invest in research and development in the renewables. To quote the US NGOs, who vehemently opposed practically everything that the US official delegation put forward, "market forces will do little to encourage fuelwood lots, wind pumps or small dams." The EEC, led by Britain's Secretary of State for Energy, David Howell, tried to persuade the US to support a new World Bank energy affiliate, but to no avail.

The twin fuel crises of deforestation and escalating oil prices have exacerbated the South's economic and political problems even further. Increased oil prices have pushed up transport and electricity costs and the price of industrial goods; rural electrification schemes are becoming so expensive that the people they are designed to benefit can no longer afford them; kerosene for rural cooking and lighting is becoming exorbitantly costly, and fuelwood for the same purposes is becoming scarcer. The foreign exchange obtained from the export of raw materials is now spent on imported oil instead of on the imported technology needed to promote renewable energy sources.

Attempts to portray the intransigence of oil producing OPEC countries as the cause of the Third World's current problems do not carry much conviction. Serious though the effect of increasing oil prices may be on the least developed countries, rising costs of food from the US, and debts and debt services to Western banks and governments are just as serious. OPEC's role in Third World development is often ignored by the western press. In 1979 OPEC's aid totalled almost five billion dollars, or 1.3% of its GNP, which is more than any Western country has achieved. Saudi Arabia's aid alone matches that of the US. Furthermore OPEC's aid is open to international competitive bidding, and is without strings.

These and many other factors have been latent in the economic and political climate which has encompassed UN and other international deliberations for the last decade and more, and the hard-won gains of UNERG must be viewed in the light of them.

The author of this article is examining a solar powered water pump at one of the UNERG conference exhibits.

The day before the Conference began, the *Nairobi Times* carried a pungent editorial which summed up the hopes of the developing world as follows:

> "The major industrialized nations (and this includes the Soviet Union) have been cool to the idea of sharing technology with developing nations in the energy field. To the extent that any technological transfer has taken place in the energy field, it has been done mainly through private multinational concerns and at an exorbitant price to developing nations. Whilst the high technology gadgets which are currently on display in Nairobi at the energy exhibition may attest to human ingenuity in finding alternatives to petroleum, coal and nuclear energy, it is unlikely that any developing nation is going to be in a position to make use of these gadgets in the near future because what the multinational companies are selling to the Third World countries is not technology but technological gadgets, and until there is meaningful transfer of technology from the developed to the developing nations to embark on sustained alternative energy programmes at costs which they can afford." [1]

NORTH AND SOUTH IN CONFLICT

On the first day of the Conference India's Prime Minister Indira Gandhi and President Daniel Arap Moi of Kenya attacked the rich nations for their profligate waste of fossil fuels and the misuse of funds desperately needed to arrest the global energy crisis. Indira Gandhi accused those in the industrialized world who "scramble for the pre-emption of fossil fuel deposits and the accumulation of increasingly sophisticated and energy-intensive weapon systems." She continued:

> "In their pursuit of technological advance, industrialized countries have exploited conventional energy so recklessly that they cannot now evade the responsibility of helping the developing world in its confrontation with this crippling crisis... We must move from the present international economy primarily dependent on hydrocarbons, to one increasingly based on new and renewable sources of energy."

India will not be able to find large-scale substitutes for fossil fuels, and the only solution is a two-tier reorganization of energy production and use. The upper tier would be conventional, non-renewable energy, while the lower tier would consist of developing

the sources of renewable energy that the North had largely abandoned. Technologically advanced nations are in a much better position to develop renewable sources of energy than poorer ones, and the transfer of technology from North to South is a major task.

President Moi castigated the "hypocrisy of the North" for giving aid but denying trade. Echoing the *Brandt Report*, he warned that "the collapse of poor countries will be more expensive to treat than to prevent."

> "The great endeavour which this conference is meant to inaugurate is that of devising ways and means by which (renewable) resources can be harnessed to benefit all mankind... No one country can resolve, in isolation, their diversity of problems. The international economic situation and the energy crisis require positive, practical (action), untained by self-interest."

Canadian Premier Pierre Trudeau announced that the sum of one billion dollars had been earmarked for bilateral and multilateral assistance programmes to the South. This to be divided between "a $ 10 million increase in support for energy-related research to and conducted in developing countries" (via the IDRC), "initial capital of $ 5 million to encourage private companies to adopt new energy technologies to development needs", "the creation of Petro-Canada International... to assist oil-importing countries to exploit their own energy resources, particularly hydrocarbons", and "the creation of an Energy Affiliate to the (World) Bank to strengthen its role in energy lending." By 1985 Canadian aid as a percentage of GNP will have risen to 0.5% — still a far cry from the UN target of 0.7%. (It fell from 0.54% to 0.43% early in 1981.)

Mr. Trudeau claimed that energy conservation is not only one of the cheapest sources of energy, but that reduced Canadian consumption of oil would increase its global availability to those who need it most. Canada's track record for energy efficiency is not very good, and a recent Royal Bank of Canada report concluded that "Canada is the least efficient user of energy among countries belonging to the OECD", an effect "closely related to domestic energy prices." Canadians pay roughly half the world price for oil.

As the EEC's senior delegate at the Conference, Britain's David Howell argued cogently for accurate estimates of energy resources in each country: "We must seek to develop and encourage industrial concerns, small and large, and craftsmen, to become involved as far as possible in the process of choosing and developing equipment to apply these sources." But whereas the US perception of "market forces" presupposed a laissez-faire attitude to the multinationals, Britain and the rest of the EEC were more inclined to constrain them by political means.

The European Commission estimates that new and renewable energy sources can supply between 6 and 10% of the Community's energy by the year 2000 (cf. global estimates by UNERG personnel of 25% by the same year). In Britain the figure is expected to be 10%.

Britain's distinctive contributions to the Conference included the offer of training facilities in renewable energy technologies for Third World scientists, and a somewhat meagre sum of £ 2 million "as a special allocation for Technical Cooperation activities to assist governments in the planning of their energy resources in order to help them adjust to the situation in the world energy market." There were rumours of frantic 'phone calls between Nairobi and London following Pierre Trudeau's offer of a billion dollars. But the Iron Lady remained adamant; her Secretary of State was transferred to another Ministry shortly after his return. One cannot help but wonder, in passing, how compatible are the offer of training facilities for Third World scientists with the UK Government's current onslaught on its universities and polytechnics, and the recent massive increase in fees for overseas students!

The two most disappointing performances at the Conference were by the US and the Soviet Union. The US delegation was led by a virtually unknown lawyer who admitted under questioning that he had no experience of either conventional or renewable energy. And the Soviets, though involved in impressive solar and tidal projects in the Crimea and the Barents Sea, were reluctant to share their expertise. By contrast the Chinese rushed around showing films about biomass and telling everyone about their latest schemes. How do you get people to accept these new technologies? — the leader of the delegation was asked at a reception — "They learn by doing", he beamed.

THE CHURCHES AND THE BRANDT PROPOSALS

Representations by the Churches to UN Conferences can be made in several ways. The Holy See, as an independent State, is entitled to send a full delegation, but seldom, if ever, does so. Its desk remained vacant for the duration of UNERG.

The Commission of Churches on International Affairs (CCIA) of the World Council of Churches enjoys consultative NGO status at the UN, and its representatives are entitled to circulate documents among the delegates and to make short speeches. At UNERG there was also additional provision for all NGOs to make a collective contribution to the proceedings.

According to the WCC Submission

> "Policies and decisions concerning life styles and therefore the concept of life entail substantial ethical choices. In the area of energy policy and energy utilization there are a number of important ethical issues to be raised. Who gets the energy? Who does not? How justly is it distributed? Who gets the pollution? To what extent do we deprive future generations by our overuse of certain resources? The churches have a major responsibility in helping society find answers to these questions." [2]

The Submission proceeded to summarize the Church and Society sub-unit's preparatory work and the conclusions of the world conference on "Faith, Science and the Future" held in July 1979 at the Massachusetts Institute of Technology and attended by 500 scientists, technologists and theologians from 85 different countries. This conference made specific recommendations to national governments, and these were communicated to the UNERG delegates.

The MIT recommendations had much in common with the keynote speeches at the beginning of the Conference, and there were also strong similarities between the findings of the first two WCC Regional Energy Consultations in Madras and Chiang Mai, and the collective NGO presentation. [3] Thus actual forms of energy use should be studied *in situ* (rather than the consumption of commercially traded fuels), forecasts of future energy demand should be based on "the real needs for different forms of energy in the different sectors, rather than on extrapolation from aggregates of past fuel consumption", deforestation should be halted and if possible reversed, and the poorer countries should be encouraged to develop an autonomous capacity for energy research, development, and self-reliant energy projects.

A distinction was made between urban and rural energy crises, the former precipitated by escalating oil prices, the latter aggravated by deforestation and exploitative patterns of dependency on urban-industrial complexes:

> "Since there are two such distinct energy crises it is evident that two separate types of solutions will be required. The

interests of the rural poor who use traditional fuels is not only different but often incompatible with the interests of those living in the urban-industrial complexes. This is especially true in relation to energy policies for the short and middle term, during which periods the interests of the two groups will be very different. It is to be hoped that the present energy policies will be such that in the long run the interests of the rural and urban groups will converge."

Much of the WCC's case centred on the themes of justice, sustainability and participation, especially the right of the rural poor to participate in the decision-making processes governing their own futures. Technology must be geared to the satisfaction of fundamental human needs and must be implemented in a manner consistent with true human development.

"We believe that the energy crisis is essentially a social-political-economic crisis, in the sense that the technological possibilities have still to be matched to human needs. It is this which will have to be managed if the improvement of the lives of the poor is to be possible."

The WCC's submission made no specific mention of the *Brandt Report*, though clearly there were points of similarity. Many people, Christians among them, have found the "global Keynesianism" of the *Brandt Report* distasteful, and feel that the implementation of its proposals will delay and possibly even thwart the creation of a more just international economic order. Brandt's criticism of the transnationals, for example, are mild even by comparison with the Pope's recent encyclical *Laborem Exercens* in which he accuses the Governments of certain developing countries and the multinationals of creating as big a gap as possible between the price of finished products and the cost of raw materials — always to the detriment of landless workers. The *Brandt Report* never really grasps the nettle of human rights, nor recognizes the possibility that trade liberalization and massive resource transfers from North to South may not benefit the poorest landless populations of the Third World.

But the choice may well be between backing Brandt-type proposals in the hope that Governments will begin to take action to avert a global catastrophe, or pressing from the start for a fundamentally more just and participatory international economic and political order. The former course may break the current impasse in North-South relations, but unless quickly guided in the right direction may simply enable a fundamentally unjust economic situation to survive indefinitely. The latter course, which is closer to the position advocated by the WCC at UNERG and the stance of Third World leaders such as Indira Gandhi, may be stillborn. In which case the entire international network of trade and finance may collapse, leaving rich and poor alike to fend for themselves. There are other possibilities which include the setting up in the Third World of a system of institutions parallel to existing international ones, but for the industrialized North the options are starker, and time is running out. ■

Notes

1. *Nairobi Times*, August 9, 1981.
2. "Toward More Just and Sustainable Energy Policies", Conference Document A/CONF/100/NGO/5.
3. *Energy for my Neighbour — Perspectives from ASIA*, Reports of the Regional Consultations in Madras, India and Chiang Mai, Thailand of the Energy for my Neighbour Programme. Edited by J. Pasztor, WCC, Geneva, 1981.

BIOMASS FOR ENERGY IN THE DEVELOPING COUNTRIES

*D.O. Hall**
G.W. Barnard
P.A. Moss

INTRODUCTION

To assess the true feasibility of biomass energy in the short term and to identify the key requirements for effective implementation in the future, it is vital to understand the realities of the social, economic and political systems in developing countries. Whilst it goes without saying that these "realities" vary tremendously between countries and that they are constantly changing under the influence of modernisation, population growth and other factors, coming to grips with them is probably the single most important precondition for effective progress in solving their energy problems.

In this context and at the risk of over-generalisation and over-simplification, some of the important features of the present systems within developing countries are outlined in the following sections.

MICRO-LEVEL SOCIAL AND ECONOMIC FEATURES

To assist in the understanding of local energy problems and to provide insight into how new energy schemes will be received, it is important for planners to have some impression of the criteria on which local people base their decisions — and the constraints placed on these decisions by social and economic factors. Clearly, traditions and behaviour patterns differ tremendously both between and within countries. However, so as to provide a basis for further discussion, an attempt has been made below to highlight some of the attitudes and social characteristics that are prevalent within developing countries (particularly the poorer sectors) and are important in determining the acceptance of new energy schemes. This crude, "thumb-nail sketch" is divided into four categories, as follows :

1. Perception of Energy Problems

For the energy analyst, from his external vantage point and with his scientific knowledge of the effects of deforestation, nutrient depletion and population growth, the energy problems of the poorer sectors in the developing countries may seem very clear. This perception is not always shared by the local populations affected by these problems, however, and this difference in viewpoint can often explain their apparent lack of interest in new energy schemes. For the family that can still find fuel from one source or another, without a huge expenditure of time or money, there may be a number of far more pressing concerns to think about — such as providing tomorrow's meal — rather than

* Excerpts from chapter-6 of *Biomass for Energy in the Developing Countries*, by Hall, Barnard and Moss, Pergamon Press, Oxford, 1982. Reprinted by written permission of authors.

worrying about the long term impact of their fuel collection habits or the thermal efficiency of their stoves. Thus, even in situations where the environmentalist can see impending ecological crisis, it is not uncommon to find wasteful use of fuel resources such as deliberate starting of brush fires and allowing cooking fires to die down naturally rather than dousing them to conserve fuel.

2. The Importance of Tradition

Traditions are often one of the major impediments to change in any society and in the rural areas of the developing countries traditions are particularly strong. Whilst some traditions are clearly anachronistic, others are reflections of an underlying rationality that has evolved over many years to cope with the problems of survival in an often harsh environment. The fact that they have persisted is, in a sense, proof that they have been (on the whole) successful.

Traditions are often deeply ingrained in the way of life of rural populations, playing an important role in maintaining cultural integrity and community cohesion. For this reason, changing traditional practices can often have a variety of hard-to-predict side effects, not all of which are beneficial. Changing the traditional patterns of fuel collection and use is probably a necessity, however, if rural energy problems are to be solved. In view of the deeply-held nature of these traditional practices, however, this change will inevitably be slow and new schemes must be demonstrably attractive if they stand a chance of being accepted.

In addition to traditions governing current energy practices, taboos can also grow up regarding the adoption of new schemes. The classic example of this is the resistance that has been met in many parts of the world to the use of animal dung and human excreta for biogas generation where (as in the West) human and animal faeces are regarded as "dirty", these problems should not be underestimated and much time and persuasion will probably be required to overcome these inhibitions.

3. Costs and Benefits

To appreciate the reasons why energy schemes have often been rejected by local populations it is important to understand the means by which the individual within the community arrives at decisions. Although the exact reasons may not be obvious to the external observer, people base most of their decisions on what they perceive as the costs and benefits of a particular action — as compared to other possible actions. These are the costs and benefits viewed through their eyes, however, a view which can often be very different from those perceived by the outside observer. They can also vary significantly between members of the same community because of the different degree of access that individuals have to necessary resources and potential benefits.

The cost of adopting a new energy practice can be viewed in terms of the direct financial and labour inputs that will be required to bring it about, and the relative significance of this cost will obviously vary depending on the ability of the individual to provide these inputs. As well as direct costs, however, there are indirect costs which relate to the benefits that will have to be foregone by taking that particular action — as opposed to doing nothing, or adopting another course. In situations where resources are limited these indirect costs are liable to be as important as the direct ones, although they are difficult to quantify in financial terms.

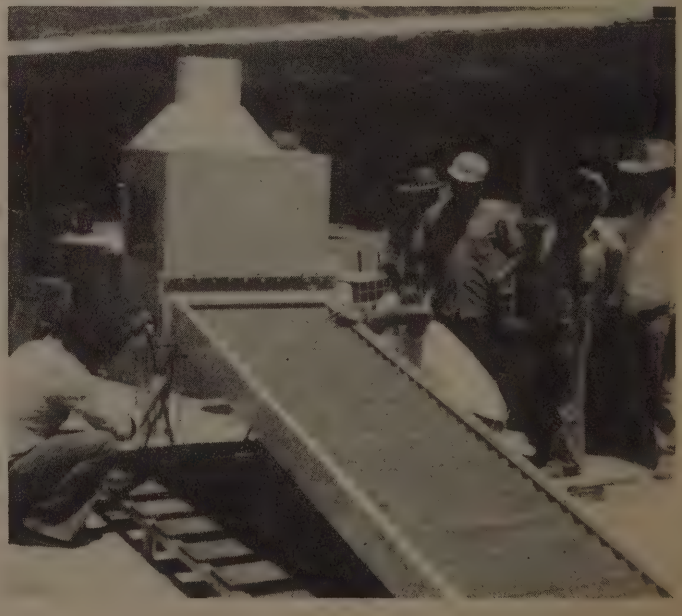
The benefits that accrue to an individual from adopting a new energy practice can also be of a direct or indirect nature and can occur over various timescales. If a new energy scheme results in the production of a saleable product (such as a commercial fuelwood plantation), or the reduction in consumption of a purchased fuel (such as an improved stove to an urban dweller), benefits will be of a direct financial nature. This will improve the overall desirability of the scheme considerably, since it provides a means of paying back the original investment and gives a direct incentive to the user. Such schemes will also be more susceptible to diffusion by normal market mechanisms.

More problematical, however, are those schemes which yield no direct or immediate financial gains and only more diffuse benefits such as increased conservation of fuel, convenience, environmental improvement, gradual increases in soil fertility or better public health. This situation applies to many domestic energy schemes directed at rural populations who presently gather fuel as a "free good". While fuel conservation would obviously be a great asset if present fuel collection practices are very laborious, it would be a much less compelling argument if the burden of gathering fuel is only moderate in comparison to the many other daily tasks that must be performed (as is more commonly the case).

A feature that has been realized in relation to the introduction of new cooking methods is the important role that women play in determining the acceptance of these ideas. Women are integrally involved in the fuel gathering and cooking processes and it is frequently the costs and benefits through their eyes that determines the rate of adoption of new methods; although it is also dependent on the degree to which women take part in decision making over financial matters.

One of the common problems relating to renewable energy schemes is that long term and indirect benefits are often either not perceived by the individual, or are overshadowed by the short term costs. To the government, on the other hand, these are often the primary motive for promoting a new energy scheme. A further problem is that, where indirect benefits are significant, they don't always necessarily accrue to the individual who pays the cost of adopting a new energy practice. Thus, for the landless peasant, the benefits derived from more efficient recycling of soil nutrients (through use of a biogas digester, for example, or from switching away from crop residues as a fuel) are likely to go primarily to the landowner in the form of improved crop yields. On the larger scale, many of the benefits from adopting more ecologically sound forestry practices in upland regions go to the populations living downstream, in the lowland areas, in the form of reduced flooding and siltation. In both cases, unless the direct benefits to the individual who pays the cost of adopting a new energy practice are also significant, overall motivation is likely to be very much reduced.

A solar drier made by the Peruvian ITINTEC group.



4. Village Power Structures and Inequality

From the experience that has been gained to date in implementing rural energy schemes (as well as other innovations), it is becoming increasingly clear that factors relating to political power structures and inequalities at the local level are extremely important in determining who can adopt new energy schemes and who will benefit from them.

The nature of power structures and the degree of inequality, varies tremendously between different parts of the world. In Asia and Latin America inequalities are particularly severe, being reflected primarily in land ownership patterns.

At the bottom end of the equality scale are the landless, who in many countries represent more than a quarter of the rural labour force and the near-landless who own only small plots of land. These groups scrape a highly tenuous existence through share-cropping or hiring out their labour for very meagre wages, and often exist in severe debt, unable to receive credit except at exorbitant interest rates.

Under these conditions of extreme inequality, the scope for poorer members of the community to adopt and benefit from any new energy scheme is minimal if that scheme requires any financial investment at all. Control over the use of land and other resources and access to credit, are all in the hands of the wealthy. It is therefore not surprising that it is these groups that have generally been in the position to adopt new energy technologies in the past, thereby deriving the benefits for themselves and strengthening their relative position — in a self-reinforcing fashion. Even when subsidies and government assistance are made available, with the aim of helping the poor, it is often the more powerful members of the community that benefit most since they can control the means of distribution of aid and have the additional resources necessary to capitalise on partial grants or subsidies.

The situation with regard to land ownership is notably different in many parts of Africa. Except in former colonial settlements where plantations were established to grow coffee, sugar and other cash crops, land ownership is generally of a less formal nature than is found in other parts of the world. Population density is lower and the majority of peasant agriculture occurs on a subsistence basis, commonly involving practices of shifting cultivation. Land is allocated to individuals by community chiefs in accordance to needs and is not formally owned or passed down between generations. Land ownership, therefore, is generally not such an important determinant of wealth and power — these relying more on features such as the number of animals owned. Communal forces are probably stronger than in most Asian or Latin American countries and although absolute levels of poverty are some of the worst in the world, inequalities within rural populations are less marked than in other countries. Under these conditions, therefore, one would expect that inequality (at the local level) will be less of a constraint to the introduction of new energy schemes than poverty itself, or other factors such as traditions and the lack of technical and financial infrastructures.

INFRASTRUCTURAL AND MACRO-LEVEL CONSIDERATIONS

As well as factors relating to the eagerness and ability of individuals to accept new energy systems, the rate of adoption of these systems is also constrained by the capacity of the nation to undertake and sustain a major implementation effort. Once again this varies tremendously between countries but in many cases is a crucial factor in determining the immediate prospects for implementing biomass energy concepts. It also has implications with respect to which biomass systems are most suitable under local conditions, due to the varying requirements that different systems have for infrastructures, resources and other inputs.

The main features of developing countries relevant to their capacity to implement effectively biomass energy schemes are outlined briefly below under three headings :

1. Skills and Infrastructures

To introduce new energy schemes to developing countries certain skills and infrastructures are required, the nature of which depends very much on the particular technology being introduced. These include :

- skills in building and using new equipment;
- knowledge of improved agricultural techniques;
- local manufacturing and maintenance capabilities;
- credit facilities;
- transportation networks.

The extent to which these capabilities vary is highlighted when one compares countries like Brazil and India, which are relatively advanced in technical terms, with some of the less technically developed nations. In Brazil and India the facilities that exist in small towns for manufacturing and repairing even quite complicated equipment are very good, at least in the more affluent regions, and banking and government sponsored financing are already established (although they may not always work ideally). In contrast, the levels of skills and other infrastructures existing in some of the poorest nations are very low and this effectively rules out the adoption of sophisticated energy technologies in the short term.

2. Extension Services

As has been mentioned, one of the key factors in ensuring the success of any implementation scheme is the provision of effective extension services. These services from the interface between government planning and research capabilities and the actual energy user and are therefore required for each of the following, crucial roles :

- Perceiving the energy problems of users and understanding the constraints that they face in relation to the adoption of new energy schemes.
- Determining what energy *demands* are (as opposed to energy needs), and ascertaining what system features are required for energy innovations to be attractive to users.
- Stimulating local participation in the development and implementation of energy schemes.
- Demonstrating new techniques, training local people and providing advice and back-up.

Many of these roles can only be performed effectively through close interaction with the people involved. For this reason, a "bottom-up" approach to the diffusion of new energy systems is generally much more likely to succeed than a "top-down" approach — in which the diffusion process is essentially a one-way transfer of "appropriate" energy solutions which have been developed in isolation from the actual users. A "bottom-up" approach is not easy to achieve in practice, however. It involves organizing and assisting people to solve their own energy needs, developing *locally acceptable* responses (technical and organizational) and carrying out mutually agreed programmes.

Cooperation is obviously vital, but for this to be forthcoming people must view energy schemes as being for *their* benefit.

Developing confidence in government extension services is a crucial part in this. Employing women extension officers can be useful in this context as it can help to encourage the participation of women in developing and carrying out energy programmes. Organizing energy programmes through schools, religious organizations and other well-respected bodies can also help to gain the trust of local communities.

Depending on the particular programme, extension services will require personnel trained in a range of specific technical subjects as well as social workers and teachers. In many cases the levels of training required for extension workers is fairly modest. What is often more important is the degree of dedication of these workers, effective leadership and organization from above, and willingness to work with — and listen to — local people.

Unfortunately, very few of the developing countries can boast of having extension services that are either of the size or the quality necessary to undertake any major biomass implementation effort in the near future.

3. Planning and Research Capabilities and Legal Constraints

As well as infrastructures and extension services, strong and coordinated national leadership is required for effective implementation of new energy schemes. This is necessary for functions such as :

- overall energy planning;
- coordination of extension services;
- organization of basic and applied energy research.

Once again, relatively few developing countries have sufficiently strong or well organized central institutions to perform these roles effectively.

IMPLEMENTATION — A POSITIVE APPROACH

The previous sections have highlighted some of the underlying problems that hinder the spread of biomass energy schemes. A number of basic contradictions also exist pertaining to changes in energy use practices — contradictions between food and fuel production, between short-term imperatives and long-term costs, between the needs of the individual compared to those of the community as a whole, and between the interests of the rural population as opposed to urban dwellers.

Many of these underlying problems and contradictions are inherent in the cultural, social and political systems that exist in the developing countries. Traditions, in particular, are deeply ingrained (and important) features of societies and as such will inevitably be slow to change. Likewise, poverty will not disappear overnight, particularly in countries where it is continually re-inforced by the mechanisms of inequality that maintain present class structures. To alter this situation major socio-political changes will be required and these involve a whole range of issues that are beyond the scope of this paper (although they cannot be ignored).

Whilst these basic problems are of fundamental importance (and they should be recognized from the outset as such), they should serve to focus the attention of the policy makers and scientists on what can be done *in practice* to improve the effectiveness of implementation methods. In this context, a number of approaches can be taken to try and make biomass energy more attractive to the individual and to increase the availability of necessary financial resources. These are discussed below.

1. Technical Solutions

Although technical "fixes" *alone* are unlikely to solve any of the more fundamental problems involved in introducing new energy systems, they certainly have an important role to play. Through a variety of technical measures it is often possible to adapt biomass technologies to be more "appropriate" for a particular set of conditions and therefore increase their attractiveness to users.

For biomass production systems, the food/fuel/fodder conflict is one of the major limitations, as is the long delay between establishing tree plantations and harvesting them for fuel. These can be ameliorated in a number of ways such as by interplanting food and fuel crops (Agroforestry), planting catch crops for energy purposes during fallow periods, using only very poor and under-utilised land for growing energy crops or employing presently wasted biomass materials.

2. Economic Measures

To increase the financial attractiveness of biomass energy systems and to bring them within the budgetary range of the poorer sectors of the community a number of economic strategies can be used. These include direct grants and subsidies, setting up of low interest resolving loan funds and modification of collateral rules so as to allow borrowers greater flexibility in what they can offer as a guarantee against loans.

It must be recognized, however, that the impact of many of these strategies will be constrained by the power structures that already exist within societies. It will often be very difficult to design systems which are not susceptible to distortion by power groups and which really do allow assistance to reach the poorest members of the community. Devising ways of achieving this is likely to be a crucial part of arriving at real solutions to the energy problems of the poor.

3. Community Energy Schemes

The use of communal energy systems is an idea which has many theoretical attractions. By pooling land, skills and capital, communities can greatly increase the range of energy options open to them and they can make much more efficient use of the resources that they have. Community schemes can also permit poorer members of the community to participate and benefit from systems and technologies that they would be unable to afford otherwise.

These are likely to be difficult to achieve in highly fragmented societies in which traditions of community cooperation are weak and where conflicts of interest dominate.

REQUIREMENTS FOR EFFECTIVE IMPLEMENTATION

A wide variety of implementation approaches are possible for biomass energy systems, involving various levels of government intervention and sponsorship and differing degrees of reliance on market forces and entrepreneurial activity. Clearly, no prescription can be written to guarantee effective implementation since the environment for implementation varies tremendously between countries.

Accepting this basic proviso, however, it is possible to delineate some very general preconditions for effective and widespread adoption of new biomass energy systems :

- Energy systems should be *appropriate* for local conditions and *attractive* to potential users.
- Systems should be *affordable* to a wide sector of the population.

- Systems should be *available* along with the necessary infrastructures and programme back-up.

Based on the limited implementation experience to date it is possible to distill a number of essential elements which appear to be necessary (or at least helpful) in ensuring that these preconditions are met. These are summarized below under the heading of System Choice, Financing and Incentives, and Extension Services.

1. System Choice

- A thorough understanding of present energy use patterns and the various constraints on the expanded use and development of biomass resources.
- Involvement of local groups during all stages of planning, selection and testing of new energy systems (particularly women's groups when it is women that are primarily affected by new techniques).
- An understanding of energy (and other) problems as seen through the eyes of local inhabitants, so as to derive an insight into the relative costs and benefits *to them* of adopting new energy systems.
- An appreciation of the power structure within communities and the likely limitations that these will place on the adoption of new systems.
- Incorporation of benefits other than just energy efficiency into designs. This includes factors such as convenience, simplicity, and compatability with present energy use practices.
- Minimization of financial costs and design of equipment so that it requires the least amount of external inputs in building, operating and maintaining the system.
- Design of systems so as to yield direct financial benefits wherever possible.

2. Financing and Incentives

- Provision of financial assistance in cases where spread of technologies is limited by lack of financial resources and credit facilities.
- Targetting of subsidies and grants to poorest members of the community.
- Provision of additional incentives (financial or otherwise) to promote adoption of energy schemes which may yield only marginal benefits to the local inhabitants but which have important wider-scale advantages.

3. Extension Services

- Extension services should endeavour to set up good relations with local groups to win their trust and support.
- Persuasion of local people as to the benefits of new technologies — using a combination of demonstrations, educational efforts and propaganda; where appropriate.
- Links should be set up to encourage feedback from users and extension officers to higher level research and planning groups, to allow techniques and implementation approaches to be continually improved so as to match the needs of the local population better.
- Provision of incentives to extension officers (financial or otherwise) to enhance their prestige and encourage hard work and dedication.
- Biomass energy extension efforts should be tied in and coordinated with other development programmes (agricultural, forestry, industrial, public health, educational, etc.), at every level.
- Setting up of training schemes to provide adequate number of appropriately trained personnel (the levels of training need not always be high but large number of officers will be required to mount a major implementation effort).
- Effective leadership and coordination of extension services.
- A major commitment from top-level government bodies to promote energy projects which is both visible and backed up through positive action. ■

LEARNING FROM CHINA'S EXPERIENCE

*Robert P. Taylor**

Perhaps China's most important achievement in rural energy development since 1949 has been its ability to avoid a rapid intensification of the problems which had developed or increased during the earlier part of the twentieth century. While the country's population has grown by more than 80% during the last thirty years, new supplies of energy and efforts to solve some of the problems associated with the traditional rural energy economy have helped China avoid the widespread famine or severe ecological deterioration that often accompanies rapid population growth.

Between 1949 and 1978, the number of persons per cultivated hectare grew from 5.4 to 9.6 persons. However, through an intensification of agricultural production, the Chinese have managed to increase per capita grain consumption. Dramatic increases in both traditional and modern energy inputs have played a key role in this process. In the future, however, supplies of modern energy must be increased, probably at an even more rapid rate than in the past, in order to alleviate present shortages and enable per capita grain consumption to continue to grow.

* This article has been excerpted from Robert P. Taylor, "Conclusions — Learning from China's Experience" in *Rural Energy Development in China* (© 1981, Resources for the Future, Inc., Washington, DC, 20036) and is reprinted here with permission of the publisher.

With the growth in agricultural production , the quantity of crop by-products available for cooking and heating fuel in rural areas has greatly increased. Their production has approximately doubled since the 1930s, and this growth has been the most important single factor in meeting the increased rural demand for household fuel. Other important developments that have helped alleviate problems associated with the supply and consumption of rural cooking and heating fuels include more equitable fuel distribution through rural collective units, increases in the supply of coal for rural household consumption, progress in afforestation, new programmes to supply fuelwood, and China's biogas programme. In addition, many rural homes have been supplied with electricity for lighting. However, problems concerning household fuel shortages, protection of forests and hillside vegetation from fuel-gatherers, and the need to expand the portion of crop by-products available for animal feed and fertilizer continue to plague China, as in the past. The need for steady, serious attention to rural household fuel problems is clear.

Since the beginning of the Cultural Revolution, China has followed a balanced approach to rural energy development. Under the policy of "walking on two legs", China has emphasized both large centralized undertakings employing advanced technology, and small decentralized undertakings employing intermediate technology.

Energy development under the centralized "leg" has played the most important role in providing modern energy inputs for agriculture. Centralized energy production systems provide the petroleum fuels for agricultural machinery, most of the electricity consumed in agriculture, and the coal or other fuels used in large nitrogenous fertilizer factories. However, China's development of small-scale hydroelectric plants and small coal mines has also been significant. Their role has been especially significant in areas where transportation or distribution from centralized energy production facilities is difficult. Also, the small mines and plants have been a means of providing energy quickly, as they involve shorter lead times than larger projects.

Decentralized energy programmes have played the most important role in development aimed at easing rural household fuel problems. Reliance on centralized energy systems to solve rural household fuel problems does not present a practical option in China. Large quantities of energy are required, and a reliance on centralized systems would place a great strain on the national energy economy and involve major difficulties regarding fuel transportation. Although a small portion of the coal currently supplied to rural areas for cooking and heating comes from large mines, most of it comes from local, small mines. While the biogas programme and various afforestation programmes for fuelwood production have probably only had a major impact in a few areas, they can be expected to have a greater effect in the future. In many ways, a solid foundation for future development has been laid, and as methods to develop local energy sources for rural household consumption, these programmes may represent China's best hope for the future.

Although only part of the total rural energy picture, China's experience in the development of decentralized rural energy systems probably presents the most valuable lessons for other developing countries. China is currently a world leader in decentralized rural energy development, and in many ways the country's experience in popularizing decentralized systems during the 1970s is unique.

It should be pointed out that China's development programmes in forestry, small coal mines, small hydroelectric plants, and biogas all reflect the country's particular geography, climate, resource base, and traditions. Other developing countries with different characteristics may not be able to promote similar programmes or may have difficulty adapting certain aspects of the Chinese programmes in a new setting.

In biogas development, the tradition of collecting and composting human and farm wastes for fertilizer in China has been a major factor in the popularization of the technology. In many other developing countries, however, fertilizer from human and animal wastes may play a less important role in agriculture, and farmers may be unfamiliar with, or even opposed to, the collection of these wastes, especially night soil. In addition, some developing countries may experience difficulties in popularizing biogas technology because of inadequate manure supplies, particularly at the household level.

Chinese households usually use night soil and crop by-products in addition to animal manure, but, perhaps more important, most rural households in Sichuan and many other parts of China privately raise pigs. The manure produced by household pigs is easily collected, as the pigs are penned in. In addition, pig manure is a far better raw material than cow manure for producing biogas.

Nevertheless, the experience that the Chinese have gained over the years can clearly be valuable to other countries in which there is a potential for the development of forestry, small coal mine, and small-scale hydroelectic power or biogas programmes, provided that a degree of flexibility is maintained to account for local conditions.

RURAL ENERGY DEVELOPMENT DURING THE 1970s

The policies and attitudes toward decentralized rural energy development adopted by the Chinese during the 1970s have been a fundamental part of both the success that China has achieved and the problems that China has encountered. The methods adopted during the 1970s proved remarkably effective for the rapid popularization of decentralized energy technologies on a mass scale. However, the approach of the 1970s also caused some important problems, including low technical levels, insufficient attention to quality, cases of local mismanagement, and a lack of proper coordination in some instances. A good understanding of the advantages and disadvantages of the Chinese approach should be useful to those interested in pursuing decentralized rural energy development.

It should be recognized, however, that a broad commitment to rural development and the existence of a well developed rural organizational framework have both been critical factors in implementation of the Chinese approach. China's commitment to rural development has been important both in terms of the provision of active support for individual programmes and China's ability to realize the advantages of the integration of decentralized energy programmes with broader rural development efforts. China's commune system has provided an effective framework for development efforts which are locally based. As units based on collective ownership, communes, brigades, and teams have the power and ability to mobilize and allocate funds and labour for projects of varying size. In addition, as semi-independent units, China's communes, and to some extent the brigades and teams of which they are composed, generally have a high degree of autonomy in pursuing specific local projects, in response to their own needs and conditions. At the same time, however, strong linkages exist between communes and county governments, various government departments, and special technical organizations, and these linkages provide guidance and direction, and technical assistance for local efforts.

There is no fundamental reason to think that important aspects of China's approach to decentralized rural energy development can only be applied in other developing countries after a revolution such as China's or through the establishment of a Chinese-type commune system. However, application of many aspects may require a firm government commitment to (1) rural development aimed at meeting the needs of the rural poor, and (2) the develop-

ment or strengthening of popularly based rural organizations that have adequate linkages to regional and central governments and departments and the capacity to mobilize resources for fairly comprehensive local development programmes.

Other developing countries may wish to consider the following aspects of China's approach to decentralized rural energy development during the 1970s :

1. Low-Cost Technology, Local Materials and Labour-Intensive Methods

Policymakers in most developing countries have recognized the importance of developing low-cost, labour-intensive systems which use local materials, but in China these priorities have been pursued with a degree of intensity that rarely is found elsewhere. In turn, strict attention to low costs, simplicity of design, and a reliance on local materials and labour in the development of decentralized rural energy systems have been major factors in China's ability to diffuse the relevant technology on such a wide scale. This approach has sometimes resulted in lower quality, poorer technical performance, and lower efficiency than one might desire. However, it also has distinct advantages. If capital costs can be lowered to the point at which local people can afford them, development can proceed rapidly, local funds can be relied on for development, and heavy state subsidies, which place a burden on the state, can be avoided. In addition, when technology is relatively simple, when local materials are used, and when local labour is employed in development, technology is diffused more easily because residents can pursue projects largely by themselves, without awaiting the delivery of scarce materials or equipment.

In some areas of rural industrial development, emphasis on the use of local materials and a high degree of self-sufficiency has led to a degree of waste and neglect of quality and efficiency that is currently judged unacceptable by China's leaders. Although problems are less apparent in the decentralized energy programmes, the current leadership has pushed for greater attention to quality and efficiency than in the past. This appears to have more to do with the present stage of development or problems in other aspects of development rather than a criticism of previous attitudes toward the selection of technology.

In a situation in which both local and national capabilities in a given field are weak, the selection of especially inexpensive technology and heavy reliance on local materials and labour may be the only way that a local unit can initiate development, or *shangma* ("get on the horse"). In the beginning stages, quality or efficiency may have to be sacrificed to a degree. However, as the benefits of a project are realized and local capabilities are strengthened, it may be possible to raise technical levels and improve quality and efficiency. In addition, as development proceeds in the nation as a whole, opportunities for raising technical levels and improving quality may increase, as the national development infrastructure and capabilities in the production of necessary equipment gradually become more developed and advanced.

Chinese experience in decentralized rural energy development shows the definite advantages of a strong emphasis on low-cost technology and the use of local materials and labour as a means to achieve the rapid diffusion of technology on a wide scale. However, Chinese experience also shows that there are tradeoffs in this approach, and in some areas of rural industrial development, heavy reliance on low-cost methods and local materials may have been counter-productive. In viewing tradeoffs, it may be best to both carefully consider the alternatives for different technologies on an individual basis and the current stage of development.

2. Local Management, Control, and Participation

In keeping with the doctrine of self-reliance, local units in China have usually played the major role in planning, management, and control of specific decentralized rural energy projets. This high degree of autonomy has entailed a high level of local participation in the development process.

Often local leaders and organizations have initiated projects, but China's central or regional governments and the Communist party also have played an important role, by making vigorous efforts to promote programmes in a variety of ways. Because of a lack of detailed information and the fact that the balance appears to have varied substantially, it is very difficult to generalize concerning the balance between pressures from the top and local initiatives in promoting programmes. Learning about the potential of a given technology through the mass media, technical books, and by various meetings or exchanges, local leaders have often been the force behind the initiation of specific projects. Thus the role of China's central or regional organs in the promotion of decentralized rural energy development appears to have ranged from the exertion of strong pressures from the top on local units to pursue specific programmes to the simple provision of information or guidance concerning the possible programmes that local units might wish to pursue.

One of the major advantages to local participation in development and the delegation of much of the initiative and planning, control, and management responsibilities to local units is that strict attention can be given to local conditions.

An additional advantage to heavy local involvement in the development process is that it helps develop local pride in projects and a feeling of self-confidence. For example, when a commune pursues electrification by building its own small hydroelectric plant, commune members can obtain a great deal of satisfaction from the knowledge that the power plant is distinctly theirs, and they have managed to electrify their homes and fields through their own efforts.

While Chinese experience points out the advantages of emphasizing local management, control, and participation in development, Chinese experience also shows that problems can result when this approach is pushed too far, and planning and coordination at higher levels is neglected. Local development may require the provison of certain equipment or materials from outside a given locality, and supply must be arranged at higher levels. In the biogas and small hydro programmes, a lack of attention to the problem of supply of necessary equipment and materials has slowed down development in some cases. In addition, when central or regional planning and coordination is weak, development efforts may not be properly focused on areas where opportunities are most advantageous. This has been a major problem in the biogas programme. Finally, when local people take on most of the responsibility for planning and managing local projects, they may make serious mistakes if they have not received adequate training.

In many ways, it is difficult to achieve a proper balance between central or regional involvement in promoting, planning, and coordinating development and local involvement in gearing development toward local conditions and aspirations. On the whole, the Chinese appear to have managed this problem well in developing decentralized energy systems; while central and regional government departments and organizations have made strong efforts to promote programmes, a great deal of flexibility has generally been maintained, through emphasis on local involvement in development. Problems have been encountered because of a certain lack of attention to planning and coordination at central or regional levels, but attempts are now being made to address these problems.

3. Local Innovation, Technology Diffusion, and Training

In China's decentralized rural energy programmes, local people have not only played roles in the planning, control, and management of specific projects, they have also been involved in the technology diffusion process and the innovation associated with the adaptation of technology to local conditions. In contrast to other methods of technology diffusion, in which outside experts play the leading role in bringing new technology to an area and adapting it to local conditions, the Chinese have emphasized the training of local people to pursue such development themselves. Local people often act as extension agents, and they have been encouraged to "learn by doing". They conduct scientific experiments and employ new ideas and innovations in an effort to gear the new technology to local needs and resources. By having these experiences, residents develop technical abilities and knowledge which can be useful to the local community. A local contingent of low-level technicians is established, who in turn can train others and play a key role in operation, management, maintenance of equipment, and the conducting of scientific experiments.

Moreover, by encouraging local innovation, a wide variety of designs and techniques have been developed in China. Such innovation has been particularly evident in the construction of biogas and small hydro plants with local materials. The creativity of local people has been relied on heavily in the development of different designs that are least expensive for given local settings.

Recent reports describe problems concerning low quality levels and mismanagement in China's decentralized energy programmes. It is clear that local people have made mistakes in designing programmes, adapting technology, and operating and managing decentralized energy systems. Technical assistance and training programmes must be expanded and intensified. In many ways, China's achievements in the provision of technical assistance and the training of local people have been remarkable, and interesting techniques such as the exchange visits and conferences seem to have been effective. However, the scale of China's decentralized energy programmes implies an enormous job. In order to provide the high-quality training and technical assistance necessary to improve quality and management, a great deal of work remains to be done.

China's leadership has also recently emphasized the need to move toward greater standardization in technology in the small hydro and biogas programmes as a means to improve quality levels, to prevent a multiplicity of effort resulting in waste, and to help guard against serious mistakes and construction.

4. The Integrated Development Approach

Decentralized energy development has been but one part of a comprehensive rural development programme aimed at meeting the basic human needs of the rural population and the achievement of agricultural modernization and rural industrialization. Local leaders have the responsibility for a variety of different programmes, leading toward a more holistic approach to development than might otherwise be the case. The energy provided by decentralized systems has been used in a variety of sectors in the rural economy, including rural industry, rural households, and agriculture. Especially important, projects to provide fuelwood through afforestation, biogas fuel, or electricity from small hydro plants have usually been developed as parts of multipurpose programmes.

In local forestry development, provisions for fuelwood supply are often an integral part of "four around" planting (planting along roads, along rivers and canals, around homes, and around villages), the development of larger collective forests for protective purposes or the production of timber, fruit, nuts, or oils, or systems for closing mountainous areas to allow natural regeneration. China's small hydro plants have usually been developed as just one aspect of multipurpose water management schemes, which may be designed to improve flood control, water storage capabilities, irrigation and drainage, navigation, and fishery industries, in addition to providing electricity. In developing biogas plants, attention has been given to both the provision of a new fuel source and the improvement of rural techniques in the management of fertilizer and organic residues.

In a country such as China, where a limited amount of land and resources must meet the needs of a very large population, it is critical to try to gain the maximum benefit from available resources. The development of systems in which several benefits are gained from the same resource is an especially appropriate mode of development.

Effective management of multipurpose systems, however, can be tricky. Systems must be planned and managed so that one function is not overstressed to the detriment of another, and this can prove difficult. Available information indicates that the Chinese have experienced problems concerning balanced management in both the biogas programmes and multipurpose forestry projects.

In the biogas programme, many local units have had difficulty balancing the use of digestor slurry and sludge for fertilizer and the production of biogas fuel. Problems may be compounded by the fact that the production of gas involves the interests of individual households, while the use of digestor slurry and sludge for fertilizer primarily involves the interests of the collective. Some units have focused their attention on the use of fermentation materials for fertilizer, and neglected the fuel needs of families, while other units have only paid attention to fuel production, resulting in problems concerning the supply of fertilizer. Biogas digestors can be used in a way in which both fertilizer and fuel needs are met, but careful planning and management are critical. This is one reason why the Chinese government has emphasized the need to establish special groups at the team level to oversee the preparation of digestor inputs and to plan and manage the loading and unloading of digestors.

LESSONS CONCERNING SPECIFIC TECHNOLOGIES

Of all of China's decentralized rural energy programmes, the biogas programme has probably attracted the most attention in other developing countries. Perhaps the most important aspects of the Chinese experience that other developing countries may want to consider are the technology that is employed and the methods used for popularization of this technology.

The low cost and simplicity of the basic Chinese water-pressure digestor design have attracted considerable interest in other developing countries. Responding to this interest, the Chinese have exhibited a willingness to help other developing countries learn about the technology. Study tours have been organized, technical data has been exchanged, and one-month training seminars have been held for persons from other developing countries in Chengdu, Sichuan, in 1979 and 1980, in cooperation with the United Nations. Recently, China has also agreed to the establishment of a biogas development, research, and training centre in China, under the auspices of the United Nations Development Programme (UNDP).

While the basic Chinese water-pressure digestor design has some disadvantages when compared to some others, its development in countries interested in promoting biogas could be very worthwhile because of its cost advantages, use of local materials, and easy construction. It is important to remember, however, that the Chinese have developed a great many variations in the basic design. To help cut costs and ensure compatibility with local

conditions, other developing countries may well be advised to adopt a similar approach.

Careful consideration of Chinese methods for the diffusion of biogas technology would also be particularly wothwhile for other developing countries interested in biogas development. In areas such as Sichuan, where an emphasis on local involvement and innovation in biogas development has been backed up by a complete top-to-bottom development and management infrastructure, biogas development has been both rapid and effective. In Sichuan, a good mixture of local involvement and state assistance appears to have been achieved. Other parts of China have been encouraged to learn from Sichuan's experience, and other countries could benefit from investigation of biogas development methods in Sichuan as well.

Small hydro plants in China are only one part of integrated water management schemes, in which local needs concerning water storage, irrigation, flood control, navigation, and fishing are carefully considered in addition to local electricity needs. In fact, in creating water management schemes, electricity generation may be low on the list of priorities, and considered basically as a side benefit. Careful attention to the maximization of benefits and multipurpose functions of hydraulic structures such as dams, reservoirs, and canals has been an important element in China's success in small hydro development.

One aspect of decentralized rural energy development in China that clearly warrants further investigation is China's development of various methods to provide fuelwood through afforestation. Different localities have adopted a variety of methods aimed at providing fuelwood as part of local forestry development. Unfortunately, very little information is currently available, and it is impossible to tell how widespread the systems actually are and what impacts they have had on rural fuel problems. While there are some success stories, there are also many indications of continuing forest abuse caused by the collection of fuel at the local level, both inside and outside of various programmes for integrating fuelwood supply with forestry development.

Mass participation has been a crucial element in the Chinese forestry programme, and the establishment of a well developed hierarchy of state forestry organizations that are closely linked to local collective units has been influential in making mass participation a working reality. Through the organization of a variety of educational, training, and decentralized research activities, China's state forestry organizations have provided much of the necessary support for local forestry programmes.

In recent years, the Chinese have expressed a willingness to share many aspects of their experience in decentralized rural energy development with other countries, and it is hoped that understanding of the Chinese experience will continue to grow. In addition, it will be interesting and instructive to see how China's decentralized energy programmes develop in the coming years. During the 1980s, China's approach to decentralized energy development will probably be considerably different from what it was during the 1970s. During the 1970s, the desire to initiate development was perhaps the chief concern. Given the recent reorientation of general policies toward rural economic development and the steady advancement of China's capabilities for decentralized energy development at both national and local levels, a new stage of development may occur in the 1980s, involving greater emphasis on technical performance, quality, and efficiency. In all events, future developments in China will certainly be worth our attention. ■

REFORESTATION: THE SEARCH FOR INTEGRATED SOLUTIONS

*Rusi Engineer**

Integrated reforestation programmes are as yet unfamiliar on the Indian scene. The main features of one such programme, with specific reference to the UP hills, have been outlined in a paper presented by Madhava Ashish to the Planning Commission's Task Force on the Himalayas. In many respects it constitutes such a radical new departure from established thinking — and offers such promising rewards — that it is worth describing more fully.

The major thrust of the suggested planning strategy is on raising the productivity of the entire land area of the UP hills. Madhava Ashish emphasizes that only by generating higher levels of income and employment from the land would village people have the necessary incentive to change their traditional patterns of livelihood — and save their environment and themselves in the process.

NEW MODELS

Keeping cattle out of the forests is essential if forests are to have a chance to regenerate. This means an almost total prohibition of grazing and compulsory feeding of cattle at stall with hand-cut grass and fodder.

Areas where cattle previously grazed can then be planted with a suitable mix of fodder and other trees and grasses. After three or four years, such replanted areas begin to produce between four to six times the quantity of grass or fodder for hand cutting than they did under uncontrolled grazing — and in addition, contribute to meeting fuelwood requirements.

Thus, within a few years, stall feeding would prove even more beneficial to cattle owners than to the forests. As more fodder becomes available, underfed and half-starved cattle, which are at present producing a quarter of the milk yields they are capable of, can be up-graded through cross-breeding, producing six to eight times the milk yield presently obtained under uncontrolled grazing.

Once grazing prohibition becomes effective, afforestation and proper management of the entire afforestable area in the UP hills of 3.1 million ha would become feasible, and would fully take care of the environmental component of the problem. Under a system of stall feeding and improved management of pastures and forests, just the existing civil and *soyam* forest area of some 1 million ha (i.e. forests other than government forests) — today largely treeless, sparsely covered with grass and eroded by over-grazing — could by itself meet all the village requirements of fodder, fuelwood and small timber.

* This article first appeared in the August 16-29, 1982 issue of the *Business India*, Bombay — 400023.

Since grazing prohibition means interfering with the basic feeding needs of cattle, any attempt to ban grazing for reafforesting large areas in one year would cause enormous disruption, arouse hostility and consequent political interference. Acceptable methods are, however, available for introducing the change gradually over 12 to 16 years. These are being tried out in similar conditions in the Nepalese Himalayas (in the Tinau Watershed Management Programme) with every likelihood of success.

Under such a scheme, a beginning is made by excluding cattle grazing from one tenth of the pasture and forest land belonging to a village or group of villages. This areas is fenced off and planted with suitable fodder trees and grasses. Initially, no grass cutting is permitted but, by the fourth year, yields of hand-cut grass would be three to four times the original yield under uncontrolled grazing. In the fourth year, therefore, it becomes possible to enclose a further area three to four times as large, since loss of additional grazing area is made up for by increased productivity of the previously enclosed land.

The process is repeated until, in 12 to 16 years, the entire available area has been planted with fodder and fuel trees and grasses. Some fodder from outside would need to be provided during the first four years to compensate for the grazing forgone on the initial one tenth of the land.

A development programme along these lines would have a revolutionary impact on the hill economy, not to mention the enormous environmental benefits that would flow from the restoration of vegetal cover to the Himalayas. At an expected yield of 3.5 tonnes of wood per hectare per year which can be considered reasonable in hill conditions, the average annual production from the 3.1 million ha of afforestable area in the UP hills would be about 11 million tonnes — as against the reported figure of forest production in 1975-76 of about 1.8 million tonnes plus firewood consumption by villagers estimated at 2.2 million tonnes, i.e. a total of about 4 million tonnes.

For estimating the value of this production and the wealth that could be generated through just the forestry component of the programme, the 1980 retail prices of Rs. 882.50/cubic metre for sawn timber and Rs. 150/tonne for fuelwood prevailing in Almora may be taken as representative. On the conservative assumption that 30% of wood production is sold as sawn timber and 70% as fuelwood, the value of 3.5 tonnes of wood per ha per year (adding the value of secondary forest products as 10% of the value of primary products, and adjusting by 10% for possible losses) comes to Rs. 2,200/ha/year. At this rate, gross returns on 3.1 million ha would therefore be in the region of Rs. 6.8 billion.

Merely as an index of possible benefits to the UP hill population, if this gross return is regarded as equally distributed over the entire population of 4.3 million, it gives an additional per capita annnual income of Rs. 1,570. This may be compared with the findings of Pantnagar Agriculture University's Rural Area Development survey of Bhikiasen block, Almora district, in 1976, which gives its per capita annual income as Rs. 476.

The simultaneous impact on food and milk production would be equally striking as productivity of the entire farming system is improved. Under the system of free grazing in forests, day time dung is lost; only the night dung is collected for manure. Stall feeding would make it possible to collect the entire output of dung which would then become available for application to the fields, leading to an immediate rise in food production. Since stall feeding gives a larger quantity of dung from a smaller number of animals, a reduction in cattle numbers becomes possible, thus increasing the per head availability of fodder. This in turn would lead to higher milk yields and permit the upgrading of existing cattle breeds.

A more comprehensive and rigorous attempt to quantify the estimated impact of a reforestation programme along the above lines has been made by M.G. Jackson, professor of animal nutrition at Pantnagar Agricultural University, based on a detailed ongoing survey of Dwarhat block in Almora district which is typical of the more heavily populated belt that runs across the UP Himalayas at an altitude of 1,000-2,000 metres.

SPECTACULAR BENEFITS

As is true of large parts of the UP hills, it was found that current food output of cereals is only enough to feed an average farming family for eight months in a year. After the rehabilitation of uncultivated land, and as a consequence of higher manurial inputs through stall feeding, the output of cereals would go up by 4.4 quintals per year, or enough to feed the family for an entire year.

Milk production would go up to 2.5 litres per day per family as against the prevailing average of 0.75 litres. An additional 40 quintals of firewood per year would become available, which is 25% more than at present. And an occasional surplus animal would be available for sale where there is none at present.

The monetary value of these gains in productivity is about Rs. 2,300 per family per year at current market prices. Increased revenue from government managed forests would be of the order of Rs. 40 million per year for the block as a whole (18,000 ha × Rs. 2,700/ha) or a tenfold increase over present revenue. If 20% of this revenue were to be paid out in wages and salaries to local people, each family would earn on an average Rs. 600 per year. If present income per family is taken to be Rs. 4,000 per year, the cumulative result of the above would be to increase family income by 75% to Rs. 7,000 per year.

Given that the benefits of these integrated schemes can be so spectacular, and in view of the fact that they represent the only viable approach to reforestation on a large enough scale, the question arises as to why this approach has so far been completely neglected. Even the proposed new forest bill, meant to replace the Indian Forest Act of 1927, conspicuously fails to address itself to the question of providing the necessary legislative backing for integrated, multidisciplinary solutions that have come to be known as community forestry.

The reasons for this neglect are many and varied. One important reason has to do with the historical evolution of forest departments, and the fact that professional thinking on the subject has remained the exclusive preserve of those with training in traditional forestry. Forest administrations have been concerned with commercial timber production and with management of state owned land. Their traditional concern with protection, policing, revenue collection and the production of wood as an industrial raw material has little relevance to integrated community forestry.

This "functional" approach to forest management has fostered a narrow view of forestry's role in the economic development process, and consequently, little expertise has been developed within forest departments in multi-disciplinary economic planning or land use matters.

As the FAO paper on *Forestry for Local Community Development* emphasizes, "of particular relevance will be the organizational structure of the government agencies to ensure an integrated approach. Several such agencies will usually be involved, requiring careful coordination in policy formulation and project implementation. New tenurial arrangements will be required that allow for a greater involvement of local people. Appropriate incentives and credit systems are needed to sustain the landowner or community during the initial years between planting and harvesting, in the form of annual payments calculated in the form of a rent, in relation to the crop value at harvest."

While all this and much else is an obvious precondition for successful reforestation, progress in this direction has been tardy, if not non-existent. Indeed, even the relatively simple social forestry programmes currently in progress in the country suffer from basic design flaws that are serious enough to vitiate their primary objectives.

A striking example of this was brought to light in a 1981 study of the impact of social forestry in the Kolar district of Karnataka, carried out by V. Shiva, H. Sharatchandra and J. Bandyopadhay** of the Indian Institute of Management, Bangalore. The study focuses on the farm forestry component of the state's social forestry programme, which has the limited objective of encouraging the planting of quick growing trees on private farm lands, particularly on the borders of fields, with the primary objective of meeting local firewood needs.

The study found that through the free distribution of seedlings, farmers have been enabled to put a significant amount of land under tree plantations. Impressive growth of trees is visible in many parts of the district, and is being cited as evidence of the success of the scheme. But, as the study shows, the rosy picture fades as soon as the situation is subjected to closer scrutiny.

POOR PLANNING

Although the social forestry is supposed to make a variety of species available for farm forestry, it was found that eucalyptus predominated overwhelmingly, and the utilisation of species other than eucalyptus was negligible. The area under eucalyptus in Kolar district has already reached 20,000 ha, and is expected to increase rapidly, cornering a lion's share of the 110,000 ha of farmland that is to be afforested in the next phase of the World Bank aided social forestry project.

While this may appear to be a very welcome development, the study highlights the havoc that can be caused by an elementary mistake such as an inappropriate choice of species. Forest departments have been indiscriminately promoting eucalyptus because it is quick growing, hardy, and being unpalatable, is not damaged by cattle. Since the problem is seen unidimensionally as a simple shortage of fuelwood, growing more trees becomes the automatic prescription for solving the crisis and eucalyptus becomes the obvious choice in this respect.

The project had not reckoned with the elementary fact that eucalyptus wood fetches a much higher price as a raw material for the paper and rayon industry (Rs. 250-300/tonne), and that fuelwood, though scarce, is still available at Rs. 150-200/tonne. Consequently, almost the entire production of eucalyptus wood in the district was found to be going to three mills — Harihar Polyfibre, Dandeli Paper Mills, and Seshasayee Paper and Board. None of the farmers growing eucalyptus were found to be using it themselves as fuel, nor was any being sold in the market as fuelwood except for lops and tops.

It is almost inconceivable that a multi-million project in any other sphere could be undertaken on the basis of such poor planning and such naive premises. But this is not all. The study revealed yet another unforseen outcome. Agricultural land traditionally used for growing crops like ragi pulses and oilseeds — which are the staple food of the rural poor — is being brought under eucalyptus plantations. For example, the area under ragi cultivation in Kolar district fell sharply from 1,141,000 ha in 1979-80 to only 48,400 ha in 1980-81, and correspondingly, production dropped from 99,300 tonnes to 13,400 tonnes, causing unexpected hardships particularly to the poorer sections.

** J. Bandyopadhay is member of the Energy for my Neighbour Advisory Group (See page 25) and all three authors of the mentioned report took part in the Energy for my Neighbour regional energy consultation in Madras, India, in March 1981.

SILVER LINING

As the authors themselves conclude, the failure of the social forestry project in Kolar to achieve its stated objectives is due to a neglect of elementary market forces and the simplistic assumption that "merely producing a greater quantity of any commodity automatically amounts to higher availability of that commodity to local people. The assumption fails under conditions where the higher purchasing power of distant urban-industrial groups can pull out resources without allowing them to trickle to the local people whose need is greater, but who have very little purchasing power."

Since such absence of systematic planning characterizes most social forestry programmes in the country today on which sizable sums of money are being spent, all this adds up to a depressing picture.

The situation, however, is not entirely without a silver lining. The social forestry programmes in Gujarat are among the most promising and innovative in the country. Under one scheme, the village makes over part of its *gochar* (grazing) land to the forest department for raising a plantation. Labour and protection are provided by the village. In earlier versions of the scheme, the forest department agreed to share 50% of the income on harvesting with the village, after deducting the expenses incurred. Later versions provide for making over the entire income to the village after deducting expenses.

Another pathbreaking scheme is of even greater interest: In degraded forests and in adivasi areas, a 2.5 ha plot is entrusted to a family for planting and looking after a variety of useful trees. In the interval of several years between planting and harvesting, the family is paid a wage of Rs. 250 per month. On harvesting, the income is proposed to be shared between the family and the forest department, or in later versions, the entire income is once again proposed to be given to the family.

In the country as a whole, however, while deforestation proceeds apace and poses a major threat to the nation, there is little evidence of the will, the ability or the political commitment that are necessary for an adequate response to the challenge.

On purely economic criteria, reforestation schemes and community forestry programmes are today among the most cost effective developmental measures, yet, paradoxically, they face acute resource constraints and underserved neglect. On the other hand, money is being frittered away on *ad hoc* tree planting schemes that have little chance of success. Conceptual confusion abounds, as we saw, even with regard to a basic understanding of causes. The problem is virtually unrecognized in universities or research institutes: there is hardly any base of multi-disciplinary expertise engaged in the serious study of diverse aspects of the problem.

This is particularly ironic when, as Bandyopadhay states, "rational policy makers will have to turn to trees by the end of the century for capturing solar energy, not only for domestic purposes but also for power generation industrial purposes. Land use is going to be the central technology in the coming decades for the absorption, transformation and storage of solar energy." Besides meeting the fuelwood requirements of the rural population, there is a tremendous potential for substitution of wood for other energy sources in industry and agriculture through wood fired power plants and small scale wood gasifiers. But all this will first require major organizational changes for the production of biomass in vastly enhanced quantities.

The sheer magnitude of the problem of reforesting the country's degraded lands is such that, on any reasonable reckoning, it is far beyond the financial and manpower capacities of forest depart-

ments and governmental agencies alone. On the other hand, the commercial returns today from technically sound and well managed plantations are extremely attractive. There is no reason why the organizational skills and financial resources available with voluntary agencies and with the private sector cannot be harnessed on a substantial scale in this task. Their effective co-operation with government agencies will, however, require new and innovative arrangements — such as different types of leasing systems; crop sharing and profit sharing schemes between local communities, government agencies and the private sector — which have been successfully pioneered in other countries.

POLITICAL WILL

None of this will happen without the requisite political will. Government policy towards public lands is fuelled by two powerful, if contradictory, forces which serve to maintain the *status quo*. The first is the populistic tendency to leave unchanged the claims rural people make on common resources to satisfy their basic needs, which is reinforced by the reluctance to tamper with the political power in village India. The second is the authoritarian preference for state control of the public domain in order to strengthen governmental authority and maintain a balance of public and private ownership thought necessary for promoting equitable development.

The productive management of common lands as a policy aim invariably loses out to this powerful combination of forces. How this crucial conflict resolves itself in the long run remains an open question.

Much will also depend on the lessons that are learnt from the present crop of "first generation" social forestry programmes. Some of these have been going for about a decade now under different agro-climatic and socio-economic conditions, and a body of experience is coming into existence which awaits comparative analysis and critical evaluation to help identify the factors that could lead to success or failure in particular situations.

But if anything useful is to come out of such introspection, the winds of change will have to start blowing through the musty corridors of New Delhi's Krishi Bhavan and its counterparts in the state capitals. Foresters will have to risk the insecurity of exposing themselves to economists, planners and administrators, agricultural and livestock experts, workers in rural development, social scientists, management experts and many others if there is to be any hope of moving towards integrated solutions. Unless such a process of cross-fertilisation starts very soon, prospects for the greening of India are indeed bleak. ■

ENERGY MEGAPROJECTS IN CANADA, MEXICO AND BRAZIL

*John Dillon**

The Canadian Churches, acting through the ecumenical GATT-Fly project, have become very critical of the negative social, economic and environmental consequences of huge resource development projects in Canada. GATT-Fly has been mandated by the churches to assess these projects from the point of view of their impact on the less powerful and less affluent sectors of society — the workers, farmers, native peoples and fishermen. The result of this inquiry has been published in a book entitled *Power to Choose: Canada's Energy Options*. [1] The thesis of the book is that Canadians have to choose between continuing on "the corporate energy road" planned by the multinational and national energy companies and a "soft energy path" where a decentralized energy system could evolve in keeping with the goal of a more Just, Participatory and Sustainable Society.

DO MEGAPROJECTS CREATE JOBS ?

Unemployment and underemployment are among the most serious social problems affecting both industrialized and underdeveloped societies. Canada (population 24 million) currently has about 1½ million unemployed workers if those persons too discouraged to look for work are added to the official unemployment statistics. Mexico (population 70 million) has an estimated 15 million unemployed or underemployed persons subsisting as streetvendors or seasonal workers. In Brazil (population 120 million) it is estimated that urban unemployment has reached 25% of the labour force. In rural areas only 1.5 million of 5 million landless labourers have permanent jobs. The other 3.5 million subsist as "boias-frias" living on the outskirts of towns and seeking employment as day-labourers during the harvest.

In Canada resource megaprojects are often promoted as "job-creating". However, these projects are very capital intensive. For example it takes Can $ 1 million in capital investment to create a single job on an oil drilling platform in the far North. The capital cost of creating a permanent job on an oil sands plant is Can $ 2.5 million. [2] In contrast it is estimated that the same amount of fuel as would be produced in an oil sands plant could be saved if only *half* as much capital were invested in home energy conservation measures. At the same time this investment would create about five times as many jobs in local communities retroffiting homes to use energy more efficiently. [3]

In Mexico fears of the "petrolization" of the economy have been realized as investments in food production and industrial diversification have given way to concentration on the petroleum sector. Yet only 42,000 new jobs were created in 1978 and 1979 through expansion of the petroleum industry. [4] Meanwhile there are some 3 million landless campesinos and 2 million more subsisting on small plots who have not benefitted from the expansion of the oil industry.

In Brazil the emphasis on producing alcohol from sugarcane has meant a relatively more labour intensive mode of energy

* The author is the co-ordinator of GATT-Fly, a project of Canadian churches working for global economic justice. It was established in 1973 by the Anglican, Lutheran, Presbyterian, Roman Catholic and United Churches to challenge unjust economic structures in the spirit of the mission proclaimed by Jesus in the synagogue at Nazareth, "to set at liberty the oppressed." (Luke 4:18) It's mandate is to assist popular groups engaged in struggles for justice and to increase the capacity of the churches to work for justice through research, political action and popular education in the fields of energy, food and agriculture, sugar and sugarworkers and textile and clothing workers. For further information, write to : GATT-Fly, 11 Madison Ave., Toronto, M5R 2S2, Canada.

The article which follows is based on a seminar held in Toronto on May 8, 1982 lead by the author. The purpose of the seminar was to explore, whether some of the problems Canadians face with the corporate, mega-project (any project with a capital cost exceeding Can $ 100 million) approach to energy development might have parallels in two underdeveloped countries, Mexico and Brazil.

production as compared with the petroleum in Canada or Mexico. However, in southern Brazil where sugarcane is cultivated for conversion into alcohol, production is more highly mechanized than in the North East and, more importantly, the sugarcane has taken over large tracts of farmland that previously had been used for coffee and subsistance crops. For the peasant families pushed off their land to make way for large, mechanized sugar/alcohol plantations life has become more miserable. The "boias-frias" who constitute the majority of rural workers in southern Brazil earn on average less than the minimum wage. In the state of São Paulo a worker earning a minimum wage must work for 120½ hours per month in order to earn enough to purchase the minimum daily food requirement for just one person. [5] Sugarworkers earning below the minimum wage cannot adequately feed their families, much less meet other basic needs.

ENVIRONMENTAL EFFECTS

For Canada, just embarking on serious offshore exploration in the Atlantic and the Arctic oceans, the uncontrolled blowout from the Mexican oil well IXTOC I in the Bay of Campeche constitutes an ominous warning. For over two months the IXTOC well spewed some 30,000 barrels a day of petroleum into the Gulf of Mexico. The IXTOC experience showed the underdeveloped state of technology for dealing with offshore oil spills. Not only did it take over two months to cap the run-away well but the chemical dispersant used has been known to kill 90% of the plankton, vital to the food chain serving the fishing industry. Shrimp fishermen were among the first to suffer the effects of the Mexican blow-out.

In Canada's Arctic waters the dangers of an oilwell blow-out are even more treacherous. If a blow-out were to occur near the end of the drilling season there would be no way of drilling a relief well until the next summer drilling period. Millions of barrels of oil could foul the fragile Arctic environment with effects on marine life that could be devastating, especially for native hunters and fishermen. Another problems in Arctic waters is that chemical dispersants have proved ineffective at freezing temperatures.

An important lesson from Brazil's experience with the development of renewable alcohol fuels and hydro-electricity is that these sources of energy can also have great environmental costs attatched if care is not taken to minimize environmental damage. The production of each liter of ethanol from sugarcane has as a by-product from 12 to 17 liters of "slops" that pollute rivers, robbing them of vital oxygen as they decompose. [6] As fish die fishermen lose their livelihood. While some efforts are underway to find a means of dealing with these byproducts of fuel-alcohol production, they remain a warning that renewable energy is not necessarily free of environmental pollution problems.

Similarly hydroelectric dams, especially large scale projects, have had immense environmental consequences. The Tucuruí hydro dam in Brazil is the fourth largest in the world. It has already caused some erosion and flooding and it is expected that upon completion it will lead to saltwater flooding of valuable farmland and fishing grounds downstream. To make way for the dam some 216,000 hectares of forest were to have been cleared. But so far only 4,000 trees have been cleared each month when 7,000 would have to be cut down and removed *each day* if the area to be flooded were to be cleared of all tree cover. [7] If the trees are not removed the ecological consequences will be devastating as rotting timber underwater will produce acids that will not only kill off fish but also damage the hydroelectric turbines.

NATIVE RIGHTS

In Canada the fight against huge resource projects has been led by native peoples attempting to defend their aboriginal rights against the encroachment of corporations seeking to extract non-renewable natural resources. A significant victory was won in 1977 when the Dene Nation who inhabit the Mackenzie Valley with the assistance of allies in the church and labour movement defeated a plan for a natural gas pipeline across their land. While the Dene, the Yukon Indians and the Inuit are still seeking to settle their aboriginal rights with the Canadian government these negotiations are threatened by a host of other corporate plans for oil and natural gas development and transportation schemes in the North.

In Mexico some of the groups that have been most marginalized by the onslaught of petroleum development have been the indigenous peoples of Tobasco and Chiapas. An investigatory journey to these areas revealed that these native peoples are struggling to assert their cultural identity and defend their rights to the land in the face of a massive intrusion by petroleum developers.

Brazil has had one of the saddest records of genocide against indigenous peoples. Of the millions of natives who populated the area at the time of the Portuguese conquest only 500,000 survived into the latter half of this century. Since the 1964 military coup Brazil's rulers have treated the Amazon as a last frontier where in the words of one president of the agency in charge of indigenous affairs, "The Indians cannot be allowed to impede development." [8] While successive economic booms in rubber, gold, highway construction and cattle ranching have all taken their toll, the push for the development of plantations for energy crops could also pose a threat to native peoples. While the development of palm oil in the Amazon, planned as a substitute for diesel fuel, is in itself an appropriate goal, there is reason to fear that it may occur at the expense of the indigenous inhabitants of the region.

NUCLEAR POWER

There is a remarkable similarity among Canada, Mexico and Brazil with respect to the difficulties that their nuclear power industries are experiencing. Of the three countries Canada has the most mature nuclear industry with 9 operating reactors and its own nuclear technology, the Candu reactor. But the Canadian industry is in serious economic trouble and one of the solutions being sought is the sale of more Candu reactors abroad, including Mexico and Brazil among the prospective customers. Domestically there are plans to spend about Can $ 28 billion on nuclear expansion in Canada over the next 20 years *if* markets can be found for the electricity. [9] But the annual average rate of growth in demand for electricity in Canada has fallen from 7.1% in the 1950's to 5.4% in the 1970's and only 3.8% from 1977 to 1979. [10] Thus the nuclear industry is looking abroad for sales and there is talk about building reactors in Canada to export power to the United States.

Similarly in Brazil ambitious plans for constructing nine nuclear reactors over the next 20 years at a cost of US$ 24 billion have been delayed since demand for electricity has only grown at an annual rate of 3.8%, far below the 11.8% rate of growth that had been predicted. [11] Brazil finds itself with a surplus of electrical capacity in the industrial state of São Paulo even without the completion of the giant Itaipu hydroelectric project. Ten other smaller hydro projects have been delayed from 2 to 6 years. The debate in Brazil on the high costs and safety of nuclear power has been fueled by the discovery of major problems with the tubes that carry radioactive water at the Angra-1 reactor that has just come on stream five years late and only operating at half capacity. [12] A struggle over the future of nuclear power in Brazil is waged between different factions of the military who occupy important government posts. There is reason to fear that at least one faction of the Brazilian army wants nuclear technology for its military potential.

Mexico is also delaying its ambitious US$ 30 billion nuclear programme that would have seen the construction of up to 20 reactors by the year 2000. As Mexico's first reactor at Laguna Verde lags far behind schedule the federal electricity commission has postponed plans for a second reactor. Canada had lobbied hard in

Mexico City to win the contract for the reactor in the face of stiff competition from US, French, German and Swedish companies. Now any decisions about resuming the nuclear programme will lie with the incoming de la Madrid administration. Critics within Mexico argue that with its oil reserves sufficient for at least 60 years Mexico has no need for expensive nuclear power. A senior Mexican government official told the *Financial Times of London* that it would be "suicide" to continue with the nuclear programme at a time when the government is cutting other expenses and trying to solve its international debt problems.

DEBT, DEPENDENCE AND ENERGY TRADE

Since the escalation in world petroleum prices in 1973 every country has been concerned about the impact of energy trade on its balance of payments and international indebtedness. Net oil importers, like Canada and Brazil, have established policies aimed at reducing oil imports through conservation and substituting other sources of energy for oil as well as accelerating the search for petroleum within their borders. Oil exporters, like Mexico, it might be assumed, could be in a favourable position to reduce their financial dependence and use oil revenues to accelerate national development. However, a closer look at Mexico's actual trade and payments situation shows that instead of reducing its international indebtedness it has actually fallen deeper into debt.

The accompanying Table I presents data concerning the international indebtedness and trade in oil and gas for each of the threee countries. While much attention has been given to the costs of oil imports as a negative factor for the balance of payments of dependent countries, it is important to note that the costs of servicing the foreign debt outstrips the value of oil trade even in the case of Mexico where the combined value of its oil and gas sales abroad has failed to match the high cost of servicing its foreign debt. The relationship between Mexico's foreign debt and oil exports merits a deeper examination.

Back in 1976 the Mexican economy was in serious crisis. The International Monetary Fund had just intervened to impose an austerity package involving devaluation of the peso, wage controls and cutbacks in government spending in return for stand-by credits to rescue the economy. Mexico's creditors were urging the government to export more oil as one solution to its problems. The Echeverria government began to comply by declassifying certain information on the country's petroleum reserves and promoting oil and gas exports. The estimates of the size of Mexico's proved oil reserves began to grow — from 6.4 billion barrels in 1976 to 11 billion in January of 1977 to 16 billion in September of 1977 and to 20 billion in July of 1978. [13] The latest estimate from March of 1982 puts proved reserves at 72 billion barrels. [14] (When Canadians hear such claims of large petroleum reserves they are very skeptical. They recall that as recently as 1971 the oil companies and the Minister of Energy relying on data from the corporations were saying that Canada had enough oil reserves to last 923 years and sufficient natural gas for 400 years, only to be told just two years later that there was an imminent petroleum shortage.) [19]

In 1977 Mexico's Minister of Finance told a meeting of bankers in New York that "Oil will be the turning point of the Mexican economy." [15] The bankers responded with new loans, especially to Petroleos Mexicanos, the state oil company. By the end of 1981 Pemex alone owed foreign creditors US$ 20 billion or about 39% of Mexico's official foreign debt. [16] In order to finance its rapid

TABLE I

International Indebtedness and Trade in Oil and Gas

	1976	1977	1978	1979	1980	1981
BRAZIL (US $'s billions)						
Foreign Debt*	26	32	43.5	49.8	58.5	68.5**
Debt Service Costs	5.1	6.5	8.7	9.6	12.9	14.7
Fuel **Imports**	3.8	4.1	4.5	7.0	9.8	11.5
MEXICO (US $'s billions)						
Foreign Debt*	17.7	22.5	27	30.3	33.8	51.7
Debt Service Costs	2.4	3.8	6.3	10	12	n.a.
Fuel **Exports**	0.5	1.0	1.8	4	10.6	n.a.
CANADA (Can. $'s billions)						
Net Indebtedness*	48.5	53.5	61	69	78	90**
Net Interest and Dividend Payments	2.5	3.7	4.7	5.2	5.5	7**
Net Oil **Imports**	0.6	1.6	2.1	2.2	4.4	5.6
Net Natural Gas **Exports**	1.6	2.1	2.2	3.1	4.0	4.4

* It is important to note that each country has a different way of compiling statistics on its international indebtedness; so the figures in the table are not strictly speaking comparable. Brazil includes in its definition of foreign debt both government and private debts contracted abroad. Mexico counts only government and government guaranteed loans, including those contracted by the state-owned Petroleos Mexicanos (Pemex). One source estimates that if Mexico's private sector debt were added to the public debt then Mexico's foreign debt at the end of 1981 would exceed that of Brazil (see *Proceso* No. 273, 25 enero 1982, p. 29). Statistics Canada uses a very different method for reporting on Canada's external indebtedness. It calculates the value of all foreign investments and foreign loans less the investments and loans made by Canadians outside the country. Thus Canada's foreign indebtedness figures also count the value of direct investments by multinational corporations in Canada. For example at the end of 1979 72% of Canada's petroleum industry was foreign owned and between 1975 and 1979 the multinational oil companies took Can. $ 3.7 billion out of Canada in interest, dividends and other capital payments. Sources : *Latin America Weekly Report*, 6 March 1981, p. 9; *Statistics Canada.*

** Provisional data.

expansion Pemex finds itself spending more money than it earns and hence the need for continued foreign borrowing. For instance, in 1982 Pemex projects its total expenditures to be 416 billion pesos while its earnings are expected to be only 322 billion pesos. [17]

Mexico's attempt to export its way out of financial trouble has not succeeded. As Table I shows each year debt service costs have outstripped oil and gas export earnings. In 1982 with declining demand on world oil markets and falling real prices for crude petroleum corresponding with extremely high interest rates Mexico finds itself in another financial squeeze. Despite the difficulties with the strategy in the past the Mexican Petroleum Institute advises suspension of limits on export volumes designed to conserve oil and more exports as the only solution.

Compunding Mexico's problems is the deterioration in its agricultural trade which has fallen from a surplus of about US$ 750 million in 1979 to a deficit of US$ 450 million in 1980 and close to US$ 800 million in 1981. [18] Contributing to this deficit has been the neglect of the agricultural sector and the needs of Mexico's landless and marginalized campesinos while the petroleum sector has come to dominate the economy.

A WARNING FOR CANADA

What lessons can be drawn from the Mexican experience? For Canada there is a clear warning. The Royal Bank of Canada projects that some Can $ 1,400,000 million (1.4 trillion) could be spent on energy megaprojects in Canada by the year 2000. [20] To finance these projects the Royal Bank says that some $ 350 billion would have to be borrowed abroad. In turn the bankers make it clear that energy exports from these projects will be necessary to repay the sums borrowed abroad. Already one giant multinational energy company, Dome Petroleum, has borrowed $ 400 million from Japan's National Oil Company for exploration in the Beaufort Sea on a contract that stipulates that the creditors will receive a share in the production from the first three wells developed there. Under Canada's National Energy Programme Canadian consumers and taxpayers pay for 93 cents of every $ 1.00 that Dome invests in its Beaufort Sea exploration. If corporate plans for energy development in Canada are allowed to proceed Canadians will find themselves subsidizing some of the most expensive energy investments in the world for export instead of developing a genuinely self-reliant energy system.

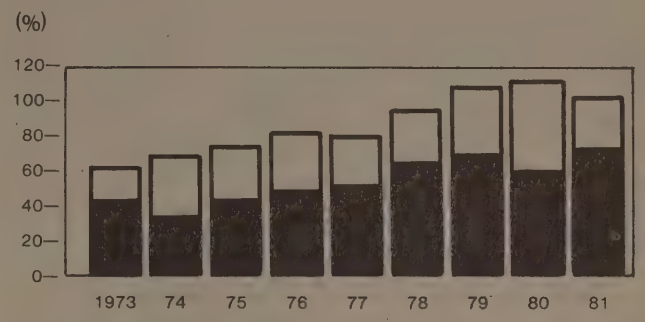
Another consequence of the megaproject approach to energy development is its social cost. According to the Royal Bank of Canada, "We will have structural room in the economy (for energy megaprojects) if... housing, government and consumer spending decline as a proportion of total spending." [21] In other words urgent social needs such as housing and government-financed programmes in the areas of health, education and welfare, as well as consumer spending will have to be pushed aside if we are to make room for the megaprojects.

As Table I shows an important part of Canada's strategy for covering the costs of imported oil and paying the interest and dividends accruing to foreign creditors and owners has been to continue to export substantial quantities of natural gas. While this policy may have an immediate short term advantages for Canada's balance of payments, in the long term it may prove very costly as Canadians will have to pay more for expensive natural gas from the frontier regions to replace the relatively less expensive southern reserves that are being sold off. In addition Canadians, and in particular the native peoples will have to endure the social and environmental consequences of developing gas reserves and transportation systems in the Arctic.

BRAZIL'S NATIONAL ALCOHOL PROGRAMME

One of the primary goals of Brazil's National Alcohol Programme is to substitute alcohol fuels for petroleum. In this respect the programme has had some success as oil's share in Brazil's total energy consumption has dropped by 6% since the inception of the programme in 1975. [23] However, as the graph illustrates, oil

Oil imports and debt servicing gobble up export earnings



■ Foreign debt servicing (amortisation plus interest) as percentage of export earnings.
□ Oil imports as percentage of export earnings.
Source: Banco Central and Adroaldo Moura. [27]

imports still cancel out a significant percentage of Brazil's export earnings. While the expansion of the alcohol industry can substitute for more of Brazil's oil imports, the real key to reducing import costs lies in changing the structure of demand especially in the transportation sector. In terms of efficiency of energy use Brazil has failed to make conservation gains equivalent to the achievements of industrialized countries. Consumption of energy per unit of production in Brazil is still as high as it was before 1973, whereas among industrialized countries oil use per unit of output fell by nearly 30% between 1973 and 1981. [24]

Despite these efforts to reduce oil imports Brazil's economic model, built on a pyramid of foreign debt, is in deep trouble. In the words of Planning Minister Delfim Neto the strategy is "to export without pangs of conscience." [25] But despite growing export earnings, the costs of imports and debt service payments have been higher. A basic problem is that production is oriented to supplying those goods that are in demand on world markets and that only the richest 20% of Brazilians can afford. Thus production of energy-intensive vehicles, electrical equipment and chemicals has grown at the expense of basic necessities. While the National Alcohol Programme is part of a solution for Brazil's economic problems, it will have to be accompanied by more basic changes in industrial and agricultural policy if the poor majority are to benefit. As Araujo and Bergman conclude in their paper on the National Alcohol Programme [26] adjustments are needed:

a) to re-evaluate growing sugarcane near consumption centres and explore crops that will grow on poorer soils in the interior;

b) to limit unregulated consumption of fuel and re-adjust patterns of energy use;

c) to stimulate mini- and micro-distilleries for small communities and thereby spread the benefits (economic rents) from the alcohol programme;

d) to recognize that alcohol cannot forever subsidize an inappropriate transportation and vehicle production industry.

CONCLUSIONS

At the end of the workshop the participants discussed the characteristics of energy megaprojects, concluding that the approach offered too many negative consequences. On the other hand participants felt that a "soft energy" path based on conservation, matching appropriate energy sources with end uses, and

development of renewable forms of energy was more appropriate to the building of a just, participatory and sustainable society. However, they also stressed that structural changes, such as land reform and the reallocation of political power, are necessary so the poor and the marginalized can participate in the benefits of a soft energy future.

Finally, while the participants were critical of the actual policies of the corporations and governments examined, they identified many hopeful signs among the social movements of workers, farmers, fishermen, native peoples and their allies in the churches and among environmentalists struggling to achieve economic, social and environmental justice. ■

Notes

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ENERGY : THE POOR IN THE USA PAY MORE

David L. Ostendorf

For the nation's poor and low-income people — and especially for the many elderly among them — the hardships brought on by today's high energy costs are devastating... and often deadly. In 1978, for example, the average low-income household spent 18.4% of its income on household fuel and utilities, compared to only 4.7% of annual income spent by the average household. In that year alone, the nation's 16.2 million low-income households (44% of which are elderly) suffered a staggering loss of over $ 4 billion in purchasing power due to energy cost increases. This occured in spite of the fact that low-income households use 54% *less* electricity and 24% *less* natural gas than the average US household, and are conserving energy to the point of jeopardizing health and, in many cases, life itself.

PRICE PROBLEMS

Energy cost increases continue unabated, having risen some 50% since 1978, and before that (1972-1978), some 152% for fuel oil and coal alone. Estimates indicate that as early as 1975, the percentage of disponisable income spent on energy in some areas of the country ranged as high as 27%, and that in 1977, many elderly poor spent as much as 50% of their disposable income on energy during the winter months. In the northern regions of the nation, of course, the impacts of rising energy costs are even further magnified; the New England region, for example, depends on fuel oil for 79% of its heating needs. Estimates are that *before* oil was decontrolled in January 1981, low-income people in the northern climes were expending between 30 and 40% of their incomes for fuel and utilities. As the price of natural gas is also decontrolled, even more people will be affected.

HOUSING PROBLEMS

The combination of high energy costs with substandard and poorly weatherized housing presents a virtually impossible situation for the nation's poor in this age of high energy costs. With the retreat from US energy policy goals of energy conservation and "self-sufficiency", energy conservation weatherization and community-based energy development programmes for the poor will be increasingly inadequate.

RURAL PROBLEMS

When one looks at the plight of the nation's rural poor, for example, the debilitating combination of spiralling energy costs and bad housing becomes painfully clear. With some 27% of the nation's population, rural USA is home to 35% of all poor and low-income people — an estimated 5.9 million households, or 42% of all low-income households in the US. Approximately 54% of all substandard housing in the US is rural, and some three-fourths of this is located in remote and inaccessible communities of less than 2,500 population. Almost 50% of all low-income people live in the North Central and Northeast regions of the country, where harsh winters are legendary. As the Community Services Administration reported in a 1977 study, "the picture which emerges quite graphically from the statistical profile of these households is that they live predominantly in rural shacks and in the shabbier sections of the US' small towns." Yet, from 1934 to 1977, only 19% of major federal housing support went to these rural communities and areas to help correct these inequities that, if remedied could have enabled the rural poor to be in a better position to cope with and pay for higher energy costs in "tighter", more energy-efficient homes.

DELIVERY PROBLEMS

Fuel oil pricing and delivery policies also impose hardships on the poor. For example, low-income consumers are often compelled to pay cash on delivery (COD) for fuel oil, given their inability to establish credit ratings that would warrant deferred payment.

Moreover, low-income consumers generally have smaller storage capacity for fuel oil deliveries. This means they must make more frequent purchases, and thereby incur the cost of more frequent price increases. It also means that they face extraordinary problems when fuel oil dealers require customers to purchase larger fuel tanks in order to minimize the number of deliveries — as has happened in recent winters.

SUMMER PROBLEMS

Winter-related energy costs do not present the only problems for the nation's poor and low-income people. In poorer and cheaply designed dwelling units — especially in mobile homes, city tenements and rural substandard housing — air conditioning is often a necessity in the summer months. The southern and midwestern summers of recent years (like that of 1980) have been a deadly force to those poor and low-income people who could ill afford the price of air conditioning. The elderly and those poor confronted by respiratory and heart ailments suffer extreme duress in record-breaking high temperatures and, unable to afford the high cost of electricity for air conditioning, succumb to death by the hundreds.

TRANSPORTATION PROBLEMS

Today's high cost of transportation also has an extraordinarily adverse impact on the poor. Cars owned by low-income people are generally older and less fuel-efficient, and consequently more expensive to maintain and to operate. Still, nearly two-thirds of low-income households in central-city areas do not own autos; some 40% of rural low-income families own no autos. Over half of all low-income people who do own cars drive them less than 5,000 miles per year. For the most part, travel by low-income people is a matter of necessity, whether it be by private car or public transportation. When that transportation is not available or affordable, the poor are unable to obtain proper medical care, shop economically at cheaper stores, or apply for, take or work at distant jobs.

CONCLUSION

These burdens of direct energy costs are multiplied for the poor when one considers how the costs of basic necessities are diven up by rising energy prices. Food is probably the clearest example. While soaring costs affect all of us, the poor are most heavily affected because so much more of their income must be spent on basic necessities. For many, the choice is increasingly whether to eat or whether to heat.

Energy. The poor do indeed pay more. And as energy becomes an issue that daily is more central to the well-being of *all* citizens, we cannot overlook or ignore the daily life-needs of those in our midst who are least able to afford the ever-rising cost of energy, and who are most directly and negatively affected by that cost. ■

Notes

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At the Tata Solar Energy Institute in Pondicherry, India the scientist is checking the wood burning efficiency of improved cooking stoves.

CHURCHES AND ENERGY — THE SCOTTISH EXPERIENCE

*Iain O. Macdonald**

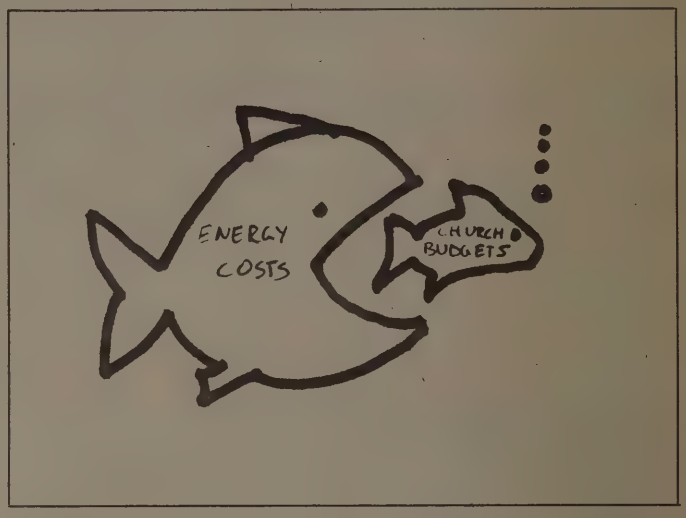
Scotland is a country of five million people, with a notoriously wet and windy climate, one of whose most publicised products (whisky) is specifically designed as an antidote to that same climate. Yet this country has a history of house building and design that has managed to produce a stock of domestic houses — more than half built since 1945 — that are heavily dependent on expensive and wasteful electric space heating, and at least 75,000 of which are affected by dampness or condensation — and that's among the new houses alone. In one housing scheme in Glasgow up to 70% of the new houses are affected by damp, with mould growing on the walls, clothing rotting, and ill health rampant.

Apparently, however, the fact that the increasing cost of fuel is adding to ill health every winter, as more and more people are unable to pay the increasing prices of fuel, has gone largely unnoticed in churches and governments alike. Maybe neither has contact with the poor, or maybe it is because the richer, middle class members of both have not personally noticed that fuel prices are increasing.

The Church of Scotland Society Religion and Technology Project has talked and taught for years about the need to husband resources justly, as a Biblical instruction and an ecological necessity. The results were scarcely observable. So, in 1978, a scheme was initiated to take advantage of Government grants available for meeting part of the costs of having an energy survey made of non-domestic buildings. The idea was that by providing a practical, down to earth, money-saving scheme for church buildings (of all denominations), congregations could take advantage of the knowledge available and, at almost no cost, reduce their energy bills and become "energy conscious". It was assumed that the money-saving aspect would make it attractive (after all, it is a Scottish programme), and that some of the people and congregations thus "conscientised" would then start applying their own self-centred church experience to their neighbours round about — particularly the poor and the old. Maybe a progressive few would recognize, learn and teach the fundamental Biblical doctrines of resource husbandry and justice.

There was one small problem. Most church people clearly did not believe that there was anything that they, far less an outside consultant engineer, could do about the way they ran their church's heating systems, either to improve their efficiency or reduce their costs. The programme was promoted with magnificent support from local and national media; even some of the church press promoted the concept. A booklet — *Make the Most of It* — was produced based on the practical lessons from the first hundred energy surveys completed. It is probably the only Church of Scotland publication ever to have been commended in a range of media from a magazine of a sister (but not often fraternal) church in Scotland, to the *Times* of London and *Le Monde* of Paris.

The figures from the churches surveyed showed that the average church in Scotland could save over 20% of its energy bills — usually by simple improved management, and hardly ever with the need for significant capital investment. Church members and leaders continue to talk about the need to raise more money, yet it has been conservatively estimated that the vast majority of the Church of Scotland administrators are, between them, almost literally throwing out of the windows, and up the chimneys, about half a million pounds a year.



Despite all this, it took ovr three years of hard work and promotion to achieve a position where now about 15% of the churches in Scotland have done something about their own energy use and where, at long last, a momentum has now apparently been built up which on present evidence will continue. The Scheme has been incorporated into the structure of the Church — it is no longer run by a maverick group on the fringe of church life — and recently the unique step was taken of appointing the first ever full-time Energy Consultant to the Church of Scotland (or any church !) whose remit allows him, as a matter of course, to spend up to 10% of his time on other-denominations' heating problems. These various steps, particularly with the booklet *Make the Most of It*, probably place the Church of Scotland ahead of any other church in organized tackling of the energy resource problem — in church buildings !

However, the original hope that such a growing awareness would lead churches to look at their surrounding parishes to improve the condition of the homes in which the 20% of the Scottish people who are observably poor live, has not yet happened. Numerous church groups have talked about "helping the poor" or opening their buildings to the unemployed to use (provided they were not then used for political purposes). Yet there remains the same reluctance to envisage either the needs or the possibilities of filling these needs that particularly the poor and the old have, in terms of improving the energy effieiency of their homes — and in keeping healthy. There is a great deal of work to be done still. ■

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ENERGY: A PARISH STORY

*Phyllis Creighton**

The Church of St. Philip the Apostle

In Toronto, Canada, in a small suburban Anglican parish of 200 families, there's an Energy Committee that's spun off from the World Council of Churches' work. Eight people — a motley group ranging from a nursery school director to a heating and air-conditioning technician — who for the past two and a half years have focused on energy conservation in the church and in their lives, for the sake of stewardship and ministry, got their first impetus from the WCC. Where and why did it all start? And what do they do?

It all began when two of us from the parish — Dr. Jim Wilkes and I — excited that we were to be delegates to the 1979 WCC conference on Faith, Science and the Future, at the Massachusetts Institute of Technology, decided to involve the congregation in studying the issues with us. With an enthusiastic planning group, we produced a five-week evening discussion series in Lent, and a further six-week programme of Sunday worship services, both with expert speakers from the church and university. These introduced us to basic notions of energy use, efficiency and entropy, soft energy paths, environmental concerns, and solar energy projects in the Anglican Church of Canada. Because of the interest generated, we agreed to run the annual parish fall conference — a weekend in the country for some 50 people — around faith, science and the future. And on our return from MIT, energy seemed a key focus for the congregation of St. Philip the Apostle.

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Since the parish conference is meant to help us reflect on theological questions and responses, we sent the participants a short piece from the MIT materials — the report of the Zürich consultation on nature, humanity and God — addressing the human predicament of our unjust, technologically based consumer society and the pat answers given to it. At the conference three experts presented a range of viewpoints. A University of Toronto nuclear physicist favouring nuclear power gave reassurances about the risks it involves. John Foster, a historian active in human rights work in the church, drawing on insights gained with us at MIT, urged that the community must participate in resolving ethical questions such as Candu reactor sales to dubious régimes, and the environmental risks in uranium mining and storage of nuclear wastes; he also stressed that Canada should use nuclear energy as a bridge to renewable energy sources, and move from a capital intensive model concentrating power in fewer hands to a more participatory, sustainable society. The theme of a conserver society was brought home by Ursula Franklin, an engineering professor responsible for the Science Council of Canada's study on this subject. She urged us to face human and ecological problems in dealing with energy, suggesting we need a sum of more appropriate technologies, and a wider global vision focused on social justice and the finiteness of resources; but she reported other countries were doing better than Canada at conserver solutions to energy use. Her emphasis on the need to question the assumptions of experts, and her assurance that each of us can acquire needed knowledge and should be involved, stimulated a lot of interest and questioning. With the help of a brief paper on energy sources and uses, based on papers from the MIT conference, we also had some discussion about appropriate energy strategies. The well-educated, middle class group of parishioners did not identify clear ways to pick up on the difficult public issues. But people had been helped

to confront the realities of our world of affluence and poverty, of resource consumption and energy waste, and to consider the need to move on to both personal and broader economic and social change.

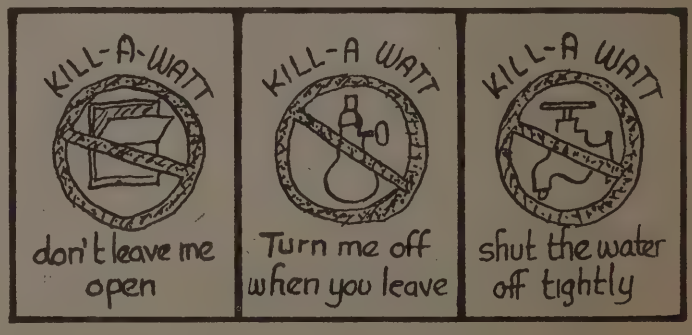
At a key point in the middle of our discussion of concrete options, we turned to biblical reflection for an hour, on the theory that major decisions should be grounded on our convictions about what is important in life. The parish had had half a dozen week-end conferences before, but had never wrestled with issues in the light of biblical insights. Indeed there was some surprise when the idea was suggested ! But the MIT experience inspired me to the experiment. It seemed important, to me, for us to reflect on what kind of difference Christian faith should make in facing energy issues. I chose three passages : Genesis 1:26-31; Job 38:1-5 and 42:1-6; Luke 4:16-19. The thematic development was : Adam — mankind at the beginning; mankind wrestling in dialogue with God; the new Adam — Jesus and liberated humanity. Noting that the Genesis passage has been condemned by some as underlying Western man's exploitation and spoliation of nature, I invited the group to consider what kind of image of God the beautiful creation poem calls us to reflect, and what kind of warrant over nature we have been given. Each of the passages, I suggested, reveals where humankind fits into the created world, what we are entitled to, and what our responsibilities are. The Job passages open up the issue of our use of authority, revealing human arrogance and folly, but also awe before God, and recognition of the need for repentance and of the reality that humankind is caught in dialogue with God, who confronts and challenges us. The gospel passage brings us full circle, to our task in community; it holds out a vision of harmony restored, of humanity recreating the world by using power and authority in God's true image to serve others as neighbours.

The participants were then asked to discuss in small groups the image of human authority and responsibilities emerging from the passages, and its implications for decisions about energy consumption and conservation. Evidently people were moved to think about the technical mastery we've acquired and the damages we've wrought, and about human need and poverty. Judging from their reports and the intercessions at the final worship service, they came back with a richer sense of the Christian calling to care in a broken world.

The planning committee had been skeptical about my announced intention to have the conference lead to action. "Conferences are for talk and fun. Nobody *does* anything as a result of them !" I like to think that the biblical reflection helped create a responsiveness in the small group of eight who decided, shortly after the weekend, to do something about the energy issue in our parish. It turned out to be a committee of individuals who could have tackled the practical steps to improving energy use in our parish on their own. In short, a committee in need of an idea ! The catalyst — a vision — had come from the WCC; the agenda developed from the practical knowledge of the members, one of whom had helped install the original heating system in the church. We took energy conservation as our focus.

The story of our work involves just one small step after the other. Having identified that utilities claimed 10% of our parish budget, we decided a conserver campaign was needed. The artist among us designed small red, black and white stickers saying *Kill-a-watt*, in three versions : leaky faucet, open door, and light bulb turned on. We never had to preach : doors were shut and lights turned off all over the building ! Next, we brushed and vacuumed the convection heat fittings for the first time in 30 years, and removed unworkable dampers. Then we looked into ceiling fans — a favourite church panacea; after we figured out how to get a thermometer high up (over a cross beam), we discovered it was only slightly colder at the top, because our gentle heating system does not create heat stratification, so we didn't need precious dollars for fans ! Carpentry repairs fixed gaps in outside doors, and then we turned to the double-glazing of windows. For educational impact we decided to start with the parish meeting room, and then go on to the coldest hallway and basement areas. We laid out the scheme in stages, asking the parish for an annual portion of what will be a four-year budget. We looked into various government programmes providing grants in return for supervision of hired labour, but decided we could do the job more cheaply and effectively ourselves. So construction and installation of permanent acrylic storm windows was undertaken by parish volunteers and also clients from our Community Resource Centre (a parish programme assisting offenders to work out their court sentences in the community). Where there's a clear purpose and leadership, willing hands can be found ! Meanwhile we converted from oil to gas, and got timed setbacks for the furnace to keep temperatures low in the main body of the church during the week, as well as an outside thermostat for better adjustment to weather changes. We checked our ceiling insulation and decided it was not useful to add to this, but installed styrofoam around a large fan that ventilates the upper gallery of the main body of the church.

After all this maintenance work the time seemed right to explore the possibilities of acquiring a passive solar heating system — an idea the committee had scoffed at initially. As a first step we visited two small churches with solar installations, and also spent a morning at Toronto's Ecology House, a government-funded project where a wealth of ideas for heat conservation and the use of solar energy is on display. One result : everyone insulated the base plugs on outside walls in their houses and at the church — 10-15% heat loss here ! — and also tackled weather-stripping, window insulation and shutters at home with a new eye ! Since the church has a hot water heating system with three separate zones controlled by individual thermostats, we received two different proposals. Both planned to use solar collectors on the south roof of the church, but one was to circulate warmed air into the nave, and the other, which involved a water system and storage, was to help heat the basement where many activities, including a daily nursery school, go on. Because we were concerned about the high cost and the relative imperfection of the technology of the second system, we chose the first. After obtaining all the details from Solartech, a Toronto company, we developed a presentation for a special vestry meeting, which included : diagrams of the system, planned to provide 12% of the heat for the nave; Solartech's estimates for installation and maintenance, and projected savings over a 20-year period, taking interest and rising costs of gas and hydro into consideration (an annual rate of return on investment of 24.4% and $ 214 the first year); funding sources — 80% potentially available as an outright government grant under a provincial programme to support the fledgling solar industry; the funds required from the parish (including a small loan), amounting to $ 5,100 on a system costing $ 23,000. We thought the scheme technically and financially feasible as well as useful, and we decided to go before the parish on this low key basis. As a committee we share a common belief that stewardship requires us to make better use of renewable resources, and that a church should be a sign in the community for new directions. But we decided not to make a theological or impassioned pitch.



It was a serious error. Three months earlier, when we had reported on the project to the annual vestry meeting and secured $ 2,000 in the budget for continued exploration of the solar option, two or three utilities' company executives had spoken against solar heating as too expensive and impracticable. But one had said we could scarcely lose with a government grant for 80% of costs and would certainly never get a better deal. He told us that Solartech was well regarded by his gas company, which had itself been examining alternative energy technologies, and he volunteered to use his skills as a planning officer in that company to help develop cost effectiveness figures. We had accepted the offer with delight ! Although we invited him to our subsequent committee meetings, and prior to the special vestry asked several times for his figures, they never were ready. But last minute efforts being normal in a parish, we let it go. That was another mistake. A number of business people of conservative bent whom we hadn't seen in some time turned out for the special vestry — we'd made no particular effort to marshall support. After our solar presentation, the gas company expert presented a complicated 10-year schedule unfavourably comparing the projected costs of gas plus solar with our existing all-gas system. There were only a few copies of his figures, so even committee members couldn't digest them; anyway, the technicalities were baffling to most of us. The figure for maintenance of the solar system was quadruple the one the company itself had given; on questioning, it turned out to be based on gas and other heating experts' general estimates. An annual increase of less than 9% was projected for gas costs, where Solartech had estimated 20%. I questioned the implied distrust of a solar company already successful in winning similar contracts and government grants, and pointed out there would be a saving of $ 1,500 on a roof repair made unnecessary with a solar installation, noting the capital investment figure should be weighed in this light. But too much doubt had been created by the complex figures put on the flip-chart by an expert long known in the congregation — the Energy Committee's business adviser thought it useless to intervene. The climate was set. Someone quietly raised the query : but isn't the real question to discover how to rely more on renewables and use up less of the irreprochable, and isn't this a theological issue ? We suddenly realized we should have gone back to our biblical and faith roots — where we had begun, and indeed still find our inspiration. The final argument, from another ex-warden : that in seeking an $ 18,400 grant we would be encouraging the government to be poor stewards with our own taxpayers' money was stunning. This issue of seeking a government hand-out for solar had already been raised at the annual vestry when we had first proposed the project, and our rector, who had been a member of the Energy Committee from the beginning, had quietly riposted then : this would be different from the millions the government has invested to enable the hydro company to give us nuclear power ? So what could we now say ? The motion to kill the project was made by the gas company expert and a hydro company executive and the vote went overwhelmingly against us.

Since then we have reflected on our political naiveté, as well as our need to analyze the figures, to query the solar company and other experts, and, above all, to call people to their faith if we decide to present another proposal. The government programme to support the solar industry is in the second year of a five-year plan. Recently, in July — and ironically — the gas company has announced a phased 18.8% rise in its rates for a church between August and March 1983, and a 17.6% increase for the subsequent period from August to March 1984. Those who said "we wanted to believe in the solar project, but the figures and the rationale just weren't there" give us hope. Meanwhile we have pondered sadly on the unexpected breakdown in our parish community and have begun to re-think our agenda. We're working on a proposal for a glassed-in vestibule for the cold north-east door. We'll help plan the spring worship series on the theme "Give us a reverence for the earth as your creation, that we may use its resources rightly." We are planning to re-examine the solar case and hope to make a better one next year. And some of us are considering whether and how to get some study in the parish of energy policy issues and the role and control of corporations and government in our society. For energy remains a key issue for the 80s, as does the goal of a conserver community more modest about humanity's place on earth and careful in stewardship, so as to have resources to minister to the needs of others, the church's true mission. ■

Toronto's Ecology House

PROSPECTS FOR TRANSITION TO A NUCLEAR ENERGY FREE FUTURE

*Günter Altner**

The Commission of Inquiry on "Future Nuclear Energy Policy" of the West German Parliament, in issuing its Report on 25 June 1980, was able to present a set of ideas on energy policy which differed in many respects from the previous debate on the pros and cons of nuclear energy. Although advocates of nuclear energy were in the majority in the Commission, a remarkable provisional compromise was reached. The Report states: "Provided that the measures listed below concerning technological development, energy conservation and greater use of renewable energy resources are vigorously undertaken and pursued, it should be examined in about the year 1990 whether

- a definitive extension of the use of nuclear energy with breeder reactor systems and all they entail proves to be necessary,
- or whether the use of nuclear energy is to remain restricted to non-breeder reactors,
- or whether it is possible to forego the use of nuclear energy in future."

FINDINGS AND RECOMMENDATIONS OF THE COMMISSION

To understand these recommendations for the years until 1990, it is important to realize that the Energy Inquiry Commission was specifically instructed by Parliament to examine, among other things, the possibilities and consequences of abandoning the use of nuclear energy in future. The Commission took this mandate seriously and, taking account of the divergence of views on energy policy represented, it presented for discussion four energy strategies for the next 50 years, which it had jointly calculated and checked. As Table I shows, very different goals in energy policy were quantified on the basis of available common data (e.g., population trends, economic growth, level of comfort of private consumers, structure of the economy, extent of energy-conservation, availability of primary energy resources: coal, oil, uranium, renewable resources).

The first energy strategy assumes high availability of energy and aims at a massive increase in the use of nuclear energy (165 GWe**, 84 GWe of this from breeder reactors). However, to reach the intended goal (high growth as a result of increasing the primary energy supply), the quantity of coal used up till 2030 is assumed to double and no substantial savings of oil are foreseen.

Energy Path 2 likewise shows a considerably increased reliance on nuclear energy (well over 100 nuclear power stations, including 54 GWe from breeder reactors). The fact that the proportion of nuclear energy in Path 2 is smaller than in Path 1, is due chiefly to the vigorous conservation measures postulated.

Path 3 and 4 do without nuclear energy for the future. They assume a very limited availability of energy, together with very large, even extreme energy conservation (the feasibility of the proposed measures was examined in detail by the experts on both sides represented on the Commission), and presuppose increasing reliance on renewable energy resources. In Path 4, which pursues this line most vigorously, economies in the use of oil are particularly striking. Oil and gas are employed solely as raw materials for non-energy purposes and to a limited extent for transport fuel needs. The figure for coal is far below the proposition needed in the nuclear energy strategies. Coal is to be used on the basis of a decentralized organization of combined heat and power stations (CHP), especially for the production of process heat and electricity for domestic and industrial use. The energy strategy indicated as Path 4 is to a large extent identical with that calculated by the ÖKO-Institut. There is no need to go deeper into the assumptions behind the calculations briefly outlined here to recognize the importance of the alternatives exemplified in Paths 1 and 2 on the one hand and 3 and 4 on the other. In comparison with the energy policy of the last decade, there is a surprisingly wide range of possible solutions and lines of action. The path that leads to vast expansion in the use of nuclear energy is by no means inevitable — quite apart from the ecological and social risks from radiation which it involves, it also has considerable disadvantages. From the point of view of supply policy (cf. the increased use of coal involved). Neither the massive development of nuclear energy, nor the increased use of coal, can lessen the Federal Republic's dangerous dependence on oil.

The contrast between Paths 1/2 and 3/4 highlights an alternative in principle between energy policies: growth and prosperity by provision of more and more energy(increased use of coal and development of nuclear energy), as against growth and prosperity by way of decreased demand for end-use energy through economical consumption (decentralized coal utilization, conservation techniques, decentralized use of renewable energy resources). The second way claims to be called "soft", because it seeks to promote growth and prosperity through an energy strategy which combines decreased energy consumption with greater social and ecological tolerability and so avoids the harsh realities of large-scale nuclear energy technology.

I leave out of account for the moment the question whether it is possible to talk at all of an alternative in principle if the quality of growth and prosperity is left undiscussed. The Commission of Inquiry's reflections on strategies were in any case made on the assumption that the basis adopted must be the public's accustomed level of consumption and, within limits, the present structure of the economy. The fact that even on this basis it is possible to describe a solid alternative to previous nuclear energy policy, indicates once again the importance of the Commission of Inquiry's Report.

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** GWe = gigawatt-electricity

ENERGY CONSERVATION OR MORE NUCLEAR FOR THE 80s ?

The provisional compromise proposed by the Commission can only be understood against the background of this list of recommendations, which were approved by the experts in favour of nuclear energy but not by the CDU/CSU deputies represented in the Commission : "It seems sensible today to rely neither on the eventual development of nuclear energy — as indicated in Paths 1 and 2 — nor exclusively on developments which could make it possible to renounce nuclear energy as foreseen in Paths 3 and 4. In view of the cogency of the two ways, the policy recommended for the 80s is intended as a fair and reasonable combination of the two alternatives and could therefore be supported by advocates of either. This assumes the existence of fair competition, the results of which can be rationally appraised." Only in the 90s when the policy recommendations concerning the conservation and utilization of renewable energy resources have been implemented, is it to be decided whether previous use of nuclear energy was a mere episode or a prior phase leading to its definitive expansion. Until then the construction of any additional nuclear power stations that may be necessary is to be guided by consumption needs, and furthermore, the nuclear option must be scientifically and technologically guaranteed.

The feasibility of a compromise of this kind is passionately disputed by both advocates and opponents of nuclear energy. It is often overlooked that the recommended agreement concerns a *temporary compromise*, a publicly verified competition between two strategies which assumes that in fact in the long term only one of the two alternatives will prevail. But isn't there reason to fear that during the test period up to 1990, energy supply enterprises, the reactor industry and state administrations will undermine and hamper measures to reduce consumption and achieve more

TABLE I

DETAILS OF THE FOUR ENERGY PATHS [1]

		Path 1		Path 2		Path 3		Path 4	
CHARACTERISTICS									
Economic Growth									
- before 2000		3.3%		2.0%		2.0%		2.0%	
- after 2000		1.4%		1.1%		1.1%		1.1%	
Structural Change in the economy		medium		medium		strong		strong	
Basic industrial growth		as GNP/2		as GNP/2		zero		zero	
Energy Conservation		as now		strong		very strong		extreme	
	1978	2000	2030	2000	2030	2000	2030	2000	2030
DEMAND SIDE									
Primary energy needs	390	600	800	445	550	375	360	345	310
Energy needs	260	365	446	298	317	265	250	245	210
Electricity needs [2]	36	92	124	47	57	39	42	36	37
Non-energy consumption	32	50	67	43	52	34	34	34	34
SUPPLY SIDE									
Coal	105	175	210	145	160	145	160	130	145
Oil and Natural Gas	265	250	250	190	130	190	130	165	65
Nuclear Electricity (GWe)	10	77	165	40	120	—	—	—	—
- of this from breeders	—	—	84	—	54	—	—	—	—
Renewables	8	40	50	40	50	40	70	50	100
OTHER ITEMS									
Electricity from coal	65	80	80	29	22	76	77	52	33
Synthetic gas from coal	—	18	50	18	56	—	—	—	—
Percentage of electricity used									
- for space heating	3	14	17	5	7	3	2	2	0
- for process heat	7	19	17	8	8	8	8	7	6
Cumulative Natural Uranium requirements (in 1,000 tonnes)		Until 2030		Until 2030					
- without reprocessing		650		425					
- with breeders		390		255					

1. Unless otherwise stated all figures are given in million tonnes of coal equivalent (mtoe).
2. Electricity requirements refer to end-use energy needs, and not to the gross production of electricity. 1 mtoe of electricity use is equivalent to 8.13 terawatthours.

Source : Drucksache 8/4341, Deutscher Bundestag - 8 - Wahlperiode.

rational use of energy? And will the consumer have enough influence, knowledge and capital to push through the soft alternative if he thinks it sensible? And will the problems involved in the large-scale development of nuclear energy (e.g. intermediate storage, reprocessing, final storage, fast-breeders, nuclear coal liquefaction and hydrogen economy) not be quicker to solve than the institutional, administrative and pressure-group resistances which today oppose an alternative energy policy and its relatively easily produced technological instruments (e.g. fluidized combustion, solar cells, production of methanol from biomass)? All that is not least a question of profits and the straitened circumstances of the public balance of payments.

In my decision to support the temporary compromise (until 1990) aimed at by the Commission of Inquiry, I always assumed that serious efforts to achieve energy-conservation and the utilization of renewable energy resources should not be impeded, and moreover that they must take priority over the use of nuclear energy. With the prospect of giving priority to energy conservation until 1990, there is no need to build more nuclear power stations in the 80s. A period of time does become available, however, in which to clear up existing defects in nuclear safety techniques (upgrading of older nuclear power stations, experiment in methods of building nuclear installations underground, technological testing of reprocessing and waste storage, analysis of weak-spot hazards for the SNR 300 which is under construction near Kalkar). All these are challenges for the future. The compromise formulated by the Commission, however, operates directly in favour of a nuclear-free energy policy to the extent that in the form of energy paths 3 and 4 it makes it possible publicly to speak of the soft energy option as a serious political alternative.

The anti-nuclear-power movement has the merit of having considerably slowed down the expansion in the use of nuclear energy in the German Federal Republic. The demand for an alternative energy policy accompanying that protest was politically and scientifically disqualified until 1980. The Report of the Commission of Inquiry on "Future Nuclear Energy Policy" opens out a new phase in the argument to the extent that the alternative energy courses calculated by the ÖKO-Institut and other groups are raised to the status of a recognized rival strategy for energy policy. All that is, of course, still only on paper and does not as yet constitute a concrete energy policy. Nevertheless the advantages attached to the situation described must not be overlooked.

If one critically appraises the pros and cons of the provisional compromise reached by the Commission of Inquiry, definite and implicit motives for a temporary compromise emerge both for advocates and for opponents of nuclear energy, as Table II shows. Starting from diametrically opposed positions (assured provision through growing supply of primary energy or assured provision through improved energy use), a provisional similarity of interests emerges in regard to the application of conservation measures and the development of renewable energy resources, to maximum economy in the use of coal and oil and to correcting safety deficiencies in the use of nuclear energy. On closer examination, the basis of these common features proves to be very slim, for the advocates of nuclear energy do not want to exploit energy-conservation to the full, but to "refine" coal into fuels by nuclear energy and to develop nuclear energy to such an extent even before 1990 that the transition to fast-breeders can quickly be achieved. The opponents of nuclear energy, on the other hand, wish to exploit the possibilities of energy-conservation and the decentralized use of renewable resources to the full, to utilize coal decentrally on the basis of CHP and to ensure comprehensive and thorough discussion of the safety of nuclear energy before risking any increase in its use. At the back of the mind of the advocate of nuclear energy lies the hope that he may be able to use the temporary compromise for a "bear-hug" technique in regard to the advocate of energy-saving, so that in the long run nuclear power will prevail. In the back of the mind of the opponent of nuclear power is the intention to prove as emphatically as possible during the period of compromise, the technical, economic and social superiority of the alternative strategy and thus pave the way for its eventual triumph.

Although in this analysis the long-term irreconcilable disagreements between advocates of breeder reactors and the soft alternative are clear, the attempt at a temporary political compromise in the sense of a genuine competition in efficiency should not be regarded as hopeless from the start. Theoretically it is quite possible to imagine a reasonably fair competition without attempts at interference by either side, with each maintaining their different long-term aims. This idea would of course also have to include the mediating supervision of a relatively impartial arbiter. At this point, admittedly, the hope I have so far cherished of the feasibility of the proposed compromise receives its hardest blow. Anyone who reflects in pragmatic political terms on the feasibility of a transition to a nuclear-energy-free future, comes to the inevitable conclusion that in the German Federal Republic, under the influence of Parliament, there is no sufficiently impartial arbiter who could guarantee the compromise on energy policy aimed at by the Commission of Inquiry. The fact of this sorry state of affairs is borne out by a good deal of evidence for the first half-year following the issue of the Commission's Report in June 1980.

PARTNERS IN A SECOND PHASE OF RESISTANCE TO NUCLEAR ENERGY

The objective handling of the controversy over nuclear energy undoubtedly achieved by the Commission of Inquiry's Report has already come under attack. The electorate must realize that the vagaries of previous energy policy cannot be put right by objective arguments alone. If the Commission's proposed temporary compromise is to be maintained (and it has everything to recommend it), a consistently firm attitude is needed on the part of critics of nuclear energy. The days of non-violent protest against proposed nuclear power stations and against those already approved and under construction, are not in fact over. Citizens critical of the use of nuclear energy must endeavour to correct the vested-interest inspired dependence of governments and their supporting parties, by persisting in democratic well-founded protest on behalf of more public welfare. Here the Commission's proposed temporary compromise represents a guideline and programme: The need of the hour is not for the building of nuclear power stations but for the promotion and implementation of conservation measures, research and development of renewable energy resources and decentralized coal utilization by means of CHP.

The Trade Unions

It is impossible not to take the trade union standpoint into consideration here. In the past, not least because of pressure from the works councils in the nuclear reactor industry and its ancillaries, the trade unions in the FRG have given massive support to the extended use of nuclear energy. This action was determined by the unions' essential and immediate concern with the defending jobs. However, it made the unions' interests much more dependent on the reactor and electricity industries than they would have liked. The situation was further complicated by the fierce controversy over nuclear energy, which gave many trade unionists the impression that it amounted to an obstructive strategy indifferent to considerations of social and employment policy. When the anti-nuclear power movement was able to link its protest with a reasoned alternative concept, however, the chances of the two sides coming closer increased. After all, there had always been critics of nuclear energy in the trade unions — varying from union to union — and, furthermore, the unions had very early on, raised the basic question of qualitative growth.

When the work of the Commission of Inquiry led to intensive contacts between ecologists and trade union representatives, a notable convergence of attitudes became apparent. The German Federation of Trade Unions' standpoint on energy policy today may be summed up in five demands: 1. A move from dependence on oil, natural gas, imported coal and uranium; 2. planned investment to promote energy-saving, rational application and use of renewable energy resources; 3. increased use of German lignite and coal; 4. building of additional nuclear plants as required, subject to the previously-listed priorities; 5. development of a safe disposal scheme, designed to test simultaneously both final storage with reprocessing and direct final disposal without reprocessing.

The present standpoint of the trade unions on energy policy presents some interesting features. The German Federation of Trade Unions assigns priority to the alternative energy strategy from the point of view of employment policy which is its own specific concern. Complete renunciation of the use of nuclear energy is rejected at the present time. Suggestions on solving the disposal problem indicate, however, that the unions still have an open mind on the use of nuclear energy in the long term. The use of fast-breeders (as a definitive step in the large-scale development of nuclear energy) is not sought. Obviously the unions can envisage the use of nuclear energy as an intermediate phase (with light water reactors only) leading to a qualitatively different energy policy for the future.

Research Into Alternatives

In regard to the future debate on energy policy, it should not be forgotten that in the past there were solid calculations and estimates which made the alternative energy strategy politically relevant and worth discussing. Small groups working independently, such as the ÖKO-Institut, were able verifiably to demonstrate that, taking into account the foreseeable development of population and economic structure in the next fifty years, it would be possible to achieve double the gross national product by better energy utilization while at the same time reducing primary energy consumption to about half the present figure. It can come as no surprise that the state centres for nuclear research which for years have neglected conservation potential and have worked on the basis of unrealistic increases in primary energy supply, have so far reacted to this standpoint with fierce criticism and allegations that the calculations are faulty. The discussion must be publicly pursued and include new inquiries into regional energy conservation programmes and potentially renewable resources. Refined analyses of conservation potential in central sectors of consumption such as the food chain and transport mobility are equally relevant. Cost-benefit analyses of that kind must also include appraisal of relevant social political assumptions and consequences.

On the other hand, the reactor alternatives (and the cycles belonging to them) which are taking shape today in plasma physics, must not be neglected either. Does the fusion-breeder or

TABLE II

FAIR EXCHANGE BETWEEN RIVAL ENERGY STRATEGIES IN THE EIGHTIES ?

I

Assured provision through growing supply of primary energy (on the basis of large-scale technological use of nuclear energy = "hard" path)

II

Assured provision through improved energy utilization (conservation, decentralized use of coal and renewable resources = "soft" path)

1981

The compromise :
Priority to application of conservation measures, development of renewable energies, coal utilization as transition, additional building of nuclear energy according to needs, solution of safety problems (especially with breeders, intermediate storage and reprocessing)

Tendency towards nuclear coal processing. Curtailment of the nuclear energy programme

Tendency towards decentralized coal utilization = CHP. Acceptance of existing operating capacities provided no safety problems arise.

1990

Overcoming the opponent by "bear-hug", strategy with a long-term tendency towards realization of large-scale extension of nuclear energy

Making up for "alternatives" that have proved inadequate. Proof of their superiority, and application

?

Such a compromise can succeed for a certain time, only if there is an actual political guarantee that it will be carried out

hybrid reactors referred to by Edward Teller present advantages over the fast-breeders and the light-water reactors, which of course prove only too clearly to be modifications of what was originally military technology? In the view of these and other possible developments, is it reasonable to stick to the fast-breeders promoted at increasing cost but with little success? And, of course, all these technical reactor strategies must also be compared with the security of supply guaranteed by the alternative energy strategy.

As long as this whole discussion is conducted among a selcted public and under the pressure of political lobbying, appropriate clarification is not to be hoped for. For this reason precisely during the period of the compromise recommended by the Commission of Inquiry, systematic promotion of research into alternatives and consequences is desirable. The search for alternative possibilities of energy supply and the development of hidden potentials is to be encouraged, as well as systematic evaluation of the safety of rival energy technologies. Real enlightenment of the public will only be possible in the period under discussion (until 1990), if the promotion of research is carried out in such a way as to ensure independence and equality of resources between state research centres and alternative research teams. Such a situation would also strengthen dissidents who do not have any say in the major research centres. The trade unions, which in their 1979 basic programme call for public control of science, independence of researchers and scientific progress directed towards social obligations, might be expected to regard research into alternatives and consequences as a movement deserving their support.

If we survey the whole range of possibilities for cooperation outlined here, the realization of the temporary compromise proposed by the Commission cannot be excluded, at least theoretically. The attempts, which began immediately after the publication of the Commission's Report, to exert pressure for the imposition of the use of nuclear energy, against better judgment, can only be stopped if critical joint action is achieved between environmentalists, trade unionists and alternative scientists. Critics of nuclear energy should not refuse (in view of the unions' freedom of action as pressure groups) if they find themselves obliged to collaborate with partners who make their attitude to nuclear dependent on what efforts are made in the next ten years. The whole point of provisional compromise is, of course, precisely to enable all of us to present for discussion the conviction that, our own standpoint is fundamentally correct, in conditions which ensure that its feasibility can be tested by all concerned. If one side breaks the rules, this can only make the other side stick even more firmly to its own standpoint.

The Churches

In these circumstances it is incumbent on the Churches an all other ideological movements which have espoused the cause of the protection of life, constantly to insist on the need for clarification. And here the ethical argument — whether a philosophical or theological basis for ethics is involved — cannot be made dependent on the obvious pragmatism of a standpoint based on feasibility. What is decisive, rather, is whether adequate safety for life and health can be guaranteed. In this respect the German Bishops' Conference has this to say: "On the other hand, however, no means of obtaining fuel can be pursued which threatens serious risk to the life of mankind from possible accidents or future side-effects. There are no grounds which could justify any exception to this rule." Precisely where this aspect of compatibility with life is the basic criterion, it proves necessary to submit different energy strategies to comparative appraisal. The temporary compromise proposed by the Commission may be described as providing conditions for a comprehensive test of compatibility with life. This raises the question of the medical, ecological, social, scientific and international compatibility of the two rival energy strategies in the Federal Republic of Germany (assured provision through growing supply of primary energy on a nuclear basis, or assured provision through decreasing consumption of end-use energy with increasing reliance on renewable energy resources).

Precisely in the context of a comprehensive socio-ethical evaluation, the chance of serious accident which cannot be excluded with the use of atomic energy (with spatially widespread and long-term consequences, in certain circumstances for thousands of years), is clearly a disadvantage which nothing can counterbalance. In ethical estimation this point of view is so weighty that the argument constantly put forward by advocates of nuclear energy that energy shortage demands the use of every kind of energy, especially nuclear energy, will not hold water. The alternative energy strategy ascertained in the meantime, however, now places the question of assured provision in quite a different light, so that the ethically quite irrelevant allegation of a breakdown in supply is quite without point today. The demand expressed by Robert Spaemann that the harmlessness of using nuclear energy must be proved incontrovertibly (without dissent among specialists), is only logical in view of the possibilities of accidents under discussion. But since the chasm which divides advocates of nuclear energy and specialists who reject it has increasingly deepened in recent years, there is no likelihood that Spaemann's well-founded criterion of incontrovertibility will be met. Furthermore, since the consideration of the various paths carried out by the Commission of Inquiry makes it appear possible to ensure energy supplies for the Federal Republic of Germany even without nuclear energy, the risk factor inherent in the use of nuclear energy stands out clearly and unqualified. From the standpoint of an ethical position of commitment to the protection of life, any attempt at compromising the compromise proposed by the Committee of Inquiry through the building of additional nuclear power stations, must appear reprehensible, even if it is endorsed by the democratically sanctioned political institutions of the Federal Republic of Germany. There must be no misuse of the Report of the Commission of Inquiry by wheeling and dealing in favour of further developments of nuclear energy.

When we survey the field of present-day energy policy groupings in the Federal Republic of Germany, a gradual transition to a nuclear-free future does not appear impossible under prevailing circumstances. Certainly the achievement of this development would require joint action by groups and people who previously have been in separate camps: environmentalists, trade unionsists, independent scientists, movements and outsiders from the political parties. The rise in energy prices, especially of oil, and the consequent worsening of the balance of payments, will cause those holding political responsibility to think over their present active preference for the use of nuclear energy. It will in fact depend on the formation of the action groups outlined here, whether the reversal takes place soon enough for burdens on the public purse through mistaken investments to be avoided and for funds to be provided to ensure that an alternative energy policy is pursued.

From the psychological point of view, the intrinsic difficulties of the joint action indicated will consist in the fact that some want to pursue radical action (abolition of all nuclear power stations today) while others can only move forward pragmatically. The coordination of these apparently very opposed modes of action requires an awareness that the intransigence of the absolute standpoint is the indispensable pivot for a gradual policy of transition. This experiment can of course only succeed if there is basic agreement in regard to the middle and long-term prospect (see Table II).

THE LONG TERM GOAL: AN ECONOMY AIMING AT A BALANCE

The ensuring of growth through reduced consumption of end-use energy by means of better utilization and decentralized use of renewable resources, is not simply continuation of the previous course of growth. The dissociation of growth of primary energy

Social Implications of Different Energy Futures

from economic growth which this strategy makes possible, represents a first step towards the redefinition of growth generally. Here we have the first elements of an alternative economic development aiming at greater balance, taking account of scarcity of energy and raw materials and including ecological, social and international conditions. The stabilization of energy consumption in society forms one element among many in the concept of appropriate technology, which can no longer be determined by the single economic principle of profitability and by growth of industrial productivity, but must be seen in relation to a multiplicity of individual and social needs. Appropriate technology itself is only one component among others in the new edifice of an economy aiming at balance. The range of methods available to an economy of that kind includes amongst others :

- Development of small, labour-intensive networks as an answer to the financial crises of the State and the criticism of bureaucracy;
- Reversal of the trend towards centralization and concentration of production associated with rapidly increasing social costs, by means of progressive decentralization;
- A raw materials policy which promotes increased durability of products, and the recycling of refuse;
- An environmental policy which promotes a re-orientation of industrial development with strict attention to health norms and measures protecting the ecosystem;
- Efforts to make the content of work more rewarding, to re-integrate extremely fragmented work processes and encourage greater participation at work, in the factory, the firm, and the life of the community;
- Concrete solidarity with the poor of the underdeveloped countries, inspiring (a relative and in certain circumstances an absolute) reduction of consumption in the industrialized countries, and not (as in the prevailing pattern) the speeding up of the process of growth.

These outlines of a new practical scheme of production and society indicate an alternative to the developments which are to be expected as a result of further increase in growth on the classical model : expansionism using nuclear energy, large-scale industrial use of solar and wind-energy, development of space travel, genetic engineering and biochemistry generally, far-ranging application of telematics. While in the context of that kind of super-industrial progress a certain amount of growth could no doubt once again be ensured, it would certainly have to be paid for by an enormous upheaval and reduction of jobs, by social and ecological destabilization, by even more state control and by uncontainable international problems (even greater deprivation in the underdeveloped countries and final destruction of their cultural identity).

As opposed to this prospect, the strategy outlined above for an economy geared to achieving balance, with selective growth and social services, represents an alternative worth considering. Joseph Huber goes even further. He puts up for discussion the "transition to a mixed, dual-economy **eco-socialism**". It is not a question of describing in detail here the various conceivable alternatives available at the present time. What is important, rather, is to reflect with great openness on the factors conditioning the possibility of intermediate alternative strategies. The important thing in the present debate on energy policy is an outlook which regards the change in technical instruments of production in the interests of greater social and ecological acceptability, as a precondition for a new social practice directed towards life. It is also important that the people who think in this way should for the moment remain firmly based in the present system and try, without any false utopianism, to prepare the way for changes of direction which will allow alternative concepts to be put into effect, at least in certain sectors. Consequently, the re-orientation of energy policy which has to be achieved in the next ten years is a decisive condition on the way to an eco-social practice which is as yet remote. On the other hand, however, this long-term perspective will be equally indispensable in bringing together all those forces (ecology movements, critical science, trade unions, churches and associations for the protection of life) which are today preparing to remove the disastrous destructive tendencies inherent in the previous growth policy, by supporting a new energy policy. ■

THE MENACE OF ACID RAIN

*Fred Pearce**

FISH ARE DYING in the lakes of North America, Scandinavia and Scotland. As they die they froth at the gills as they gasp for the oxygen and salts that would keep them alive. The cause of their death is toxic aluminium washed out of the soils by rain; rain made acid by pollution from a thousand power stations and countless cars in Europe and North America.

In the forests of central Europe —in East and West Germany, Czechoslovakia and Poland — trees die beause sulphur from power stations hundreds of kilometres away turns to acid rain and transforms the forest floor from a pool of nutrients into a cocktail of toxic metals. Again aluminiun is the principal lethal ingredient.

In Scandinavia and northern Britain acid water collects in the reservoirs and underground aquifers that provide drinking water. It corrodes water mains and colours water supplies. The metal content of tap water, such as iron and aluminium, is increased (and these can be lethal to patients on dialysis).

Across much of the northern hemisphere an airborne sea of sulphuric and nitric reduces crop yields, corrodes buildings and changes the chemical balance of the planet's atmosphere. The biggest threat is from sulphuric acid formed from the sulphur dioxide that is emitted by coal-burning and oil-fired power stations, furnaces and refineries. But nitric acid from oxides of nitrogen released in both power stations and vehicle exhausts is causing concern.

Ten years after Sweden first called the attention of the world to

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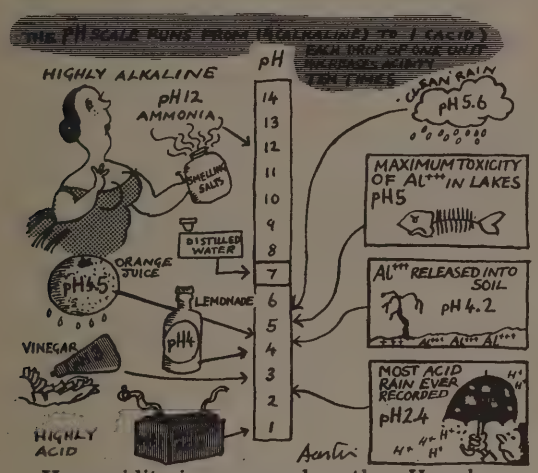
acid rain, scientists have promoted sulphur emissions to the top of the league of global pollutants. Today, 90% of the sulphur falling on the fields, forests and lakes of Europe and North America is produced by fossil fuels burnt by man. Some 25 million tonnes leave the chimneys of Europe each year, mostly from power stations. And what goes up must come down. At first the Swedes thought the death of their lakes was an isolated phenomenon. Today it is clear that acid is damaging soils and inland water in many countries in a fundamental way. It is washing away nutrients which feed plants and replacing them with toxic metals. Aluminium normally a harmless metal fixed as an organic compound in the soil in vast quantities all over the world, is converted into lethal inorganic forms by the deposition of acid. Now there is growing concern in the Third World as sulphur belches from the huge new conurbations of Latin America, India and the Middle and Far East. Corrosion of the Acropolis in Athens is now matched by corrosion of the Taj Mahal south of Delhi. The most productive farmland of China, the paddy fields of South-East Asia and the forests of the Amazon may all depend on soils as susceptible to acidification as those in Scandinavia and Germany.

Meanwhile the most acidic rain ever recorded was much closer to home — at Pitlochrie in central Scotland.



How acidity is measured on the pH scale

TREES cover almost half of West Germany. Giant primeval woodlands like the Black Forest are the traditional playgrounds for Germans. So it came as a shock when Professor Bernhard Ulrich, a quietspoken biochemist, last year told his countrymen through the pages of *Der Spiegel* that their forests are dying. The cause, he told them, is sulphur dioxide from power stations and heavy industry in the great industrial heartlands on the Ruhr and the Rhine. His claim struck a raw German nerve and, with the Green Party growing all the time, he struck a raw political nerve, too. Inside a year the German federal government is committed to halve sulphur emissions by 1990.

Now the word of Ulrich is spreading further. His theories on the effect of acid deposition on soils and forests are fast becoming the cornerstone of scientific thinking. They suggest, according to scientists who gathered recently in Stockholm to review research into acid rain, "that tree growth may be decreased... at concentrations which prevail over large parts of Europe". In the coming months Ulrich's findings will cause many countries to rethink their assumptions that the costs of cutting sulphur emissions outweigh the benefits. Not least among the rethinkers will be Britain.

Across Bavaria some 1,500 hectares of forests have died in the past five years, according to government estimates. Another 80,000 hectares of forests in Bavaria and Baden-Wurttemberg are seriously damaged. Some German forests have taken from industry doses of sulphur amounting to 100 kilogrammes or more per hectare every year for more than a century. After several years of observing forest soils deteriorating at his research station in Solling, Ulrich believes they can stand no more.

He told the Stockholm conference that "after the next warm dry years, the forest damage will drastically increase. Dead forests, till now restricted to the most centrally situated countries (Czechoslovakia, Poland, East Germany) will become apparent also in West Germany. In less exposed areas the existing forests will gradually be damaged by the die-back of trees. This die-back starts at forest edges, at suppressed trees and at trees extending beyond the canopy. Especially endangered are dense pure coniferous stands of age 20 to 40 years. In the long run trees will not get older than 30 to 40 or 50 years even under optimal soil conditions."

Ulrich says that acid deposition is causing far-reaching, probably irreversible, changes in the soil of wide areas of central Europe. The destruction goes through three phases, he says. In the first, the nitrogen content in the acid rain is dominant : it acts as an additional source of nutrients to the soil, and trees may grow more rapidly — in the past century tree growth in central Europe actually increased. That process has now stopped in Germany, but continues, in Scandinavia, where the trees thrive as the lakes die.

Today, phase two of Ulrich's cycle is taking hold in West Germany. Most soils have a natural ability to neutralise acid, and are able to replace lost nutrients such as calcium from the underlying bedrock. But this ability is becoming exhausted. Acid is accumulating first in the surface layers and then farther down. At the same time sulphate from the acid rain combines with nutrients such as calcium and magnesium and leaches them from the soil. An early sign of this phase is the yellowing of pine needles, indicating magnesium deficiency.

The loss of nutrients slows the growth of trees and damages the wood, but much worse soon follows. As the nutrients are removed so the sulphate begins to combine with metals in the soil. The most important is aluminium, which is present in huge quantities in most soils. Normally, aluminium is harmlessly bound up with organic materials. But when these links are severed and the metal goes into solution with sulphate it becomes very toxic. Today, aluminium is emerging as the main toxic agent in acid soils and lakes. The release of toxic aluminium into solution in soils marks the third and fatal phase in the saga of acid rain, according to Ulrich's thesis.

The acid reaches a critical level at a *p*H of 4.2. Below that figure aluminium is released from its "polymerisation" with organic matter and becomes toxic. Ulrich says aluminium toxicity becomes a problem as the amount of aluminium in the soil approaches the amount of calcium. It worsens when the aluminium is dominant and stops growth completely when the ratio of calcium to aluminium reaches 1:7 : one atom of calcium to seven of aluminium. At Ulrich's forest research station at Solling this ratio has fallen from 1:1 in 1972 to around 1:5 today. Dead tree tops mark this calcium deficiency. But this is only a prelude to the acute poisoning which occurs as the aluminium starts to inhibit the division of cells in the roots of the trees, and destroy its defences against disease organisms. First to be attacked are the fine root ends through which trees extract moisture from the soil. Any aluminium in the moisture will damage the root endodermis, the innermost layer of the cortex of the root which controls the movement of liquid into the plant. Ulrich says, "if the endodermis is damaged the plant has lost the ability to control the ionic composition of the sulphur entering the vessels... the plant has lost its integrity in the soil."

The toxins invade, damaging cells as they go. The tree cannot seal the damaged root system and the spores of bacteria, fungi, viruses and other pathogens invade and work their way in. In this

way secondary diseases begin. The tree is doomed. Death will come slowly by a mixture of starvation, disease and poisoning.

Other processes may reinforce the cycle of death described by Ulrich. Aluminium also damages the soil bacteria which decompose vegetation and recycle plant nutrients. As a result the soil system may start to generate its own acid which, according to Ulrich, may contribute as much to the continued acidification of the soil as acid rain.

In addition, parts of West Germany are regularly shrouded in low cloud which is often highly acidic. Aerosols of tiny sulphur particles are held in the cloud's moisture and may be absorbed by pine needles, with which they come into contact. Professor Fred Last of the Institute of Terrestrial Ecology in Edinburgh believes that these aerosols may have an especially severe effect on trees on high exposed hillsides in Germany. Spruce, the tree which has suffered more than any other in Germany, traps three times as much solid sulphur as the beech.

Ulrich believes that today some two million hectares of forests in Germany may be close to the threshold where toxic aluminium will begin to damage tree roots. "The leaching of base cations from the rooting zone is completed in many acid forest soils", he says. "The ecosystem has a very low resilience. The next warm, dry years will give rise to a new acidification push in the rooting zone... and at the same time reduce the dissolved organic matter."

Aluminium will go into solution and the trees will die. Ulrich concludes, in his slightly disjointed English, "a strong increase of forest damages in central Europe is forecasted during the next decade."

SALMON started to disappear from the lakes of southern Norway shortly after the First World War. Inland stocks of brown trout became scarce after 1920. They have disappeared from nearly 2,000 lakes and today many other species of fish are virtually extinct across 13,000 sq.km of the country. In the four southernmost counties more than half of the fish population has been lost in the past 40 years.

In Sweden they noticed the disappearance of crayfish first. Today the Swedes retain their love of crayfish but rely on imports from Turkey. Nine thousand Swedish lakes, including a large proportion in the south of the country, show heavy fish losses. Four thousand lakes are effectively dead. In both countries the cause is clear: acidification.

A tell-tale mucus clogging the gills shows that the fish are under attack — not from the acidity of the water itself but from the aluminium washed by acid rain from soils into the lakes and rivers. As in German forests, so in Scandinavian lakes: aluminium is the killer.

The fish die because the system for regulating salt in their bodies cannot cope with the toxic aluminium. The gill, a most sensitive organ, takes both oxygen and salt into the fish. Aluminium deposited on the gills inhibits this process. The fish pants for breath and, as the salt level in its body falls, proteins are destroyed and the fish eventually dies.

The toxicity of lakes develops in a way remarkably similar to processes in soils. The solubility of aluminium increases as the *p*H of the water falls. It is most soluble at a *p*H of 5, when aluminium hydroxide is precipitated in large amounts onto the gills of fish. The calcium/aluminium ratio is as important to toxicity of lakes as it is to soils. Norwegian biologists have found that lakes with a low calcium content die most quickly. The critical *p*H level for fish life to continue in a lake may vary by one unit of *p*H or more depending on the calcium level. Without calcium, toxic, inorganic forms of

The acid rain which poisons Scandinavian lakes originates from all over Europe

aluminium hydroxide dominate over harmless forms in which aluminium is chemically linked to organic material. The toxic forms are lethal to fish at concentrations as low as 70 micrograms per litre.

It is not just fish that die. Acidification changes the whole aquatic ecosystem. An acid lake is crystal clear. On the bottom a thick mat of white moss covers the sediments. A green carpet of algae covers boulders and on the shoreline leaves collect, with grass, twigs and other organic debris. The debris decomposes much more slowly and this mass of vegetation traps valuable nutrients.

The disappearance of fish allows a few invertebrate carnivores to thrive, despite the decline in plankton, insects, crustaceans, snails and mussels. Some sensitive species, such as the mayfly and freshwater shrimps and snails, die as the *p*H of the lakes drops below 6. But for most the levels of toxic aluminium secure their fate.

The discovery that aluminium is the toxic element in aquatic as well as terrestrial acidification has helped forge the scientific links between the effects of acid rain on terrestrial ecosystems and on aquatic ones. Soil chemistry is crucial to what happens in lakes. It helps explain why southern Scandinavia, where the rate of acid deposition is only a fraction of that found in central Europe, suffers such exceptional damage to lakes, and why Scandinavian forests thrive as the lakes die.

A crucial factor here appears to be the period in spring when the winter's snow melts. During this time the soils become saturated and the "snowmelt" which contains several months' accumulation of sulphur acids, washes straight through the thin soils and into streams and lakes. The normal ion-exchange processes, during which the soil is acidified and the water is neutralized, will not have time to take place.

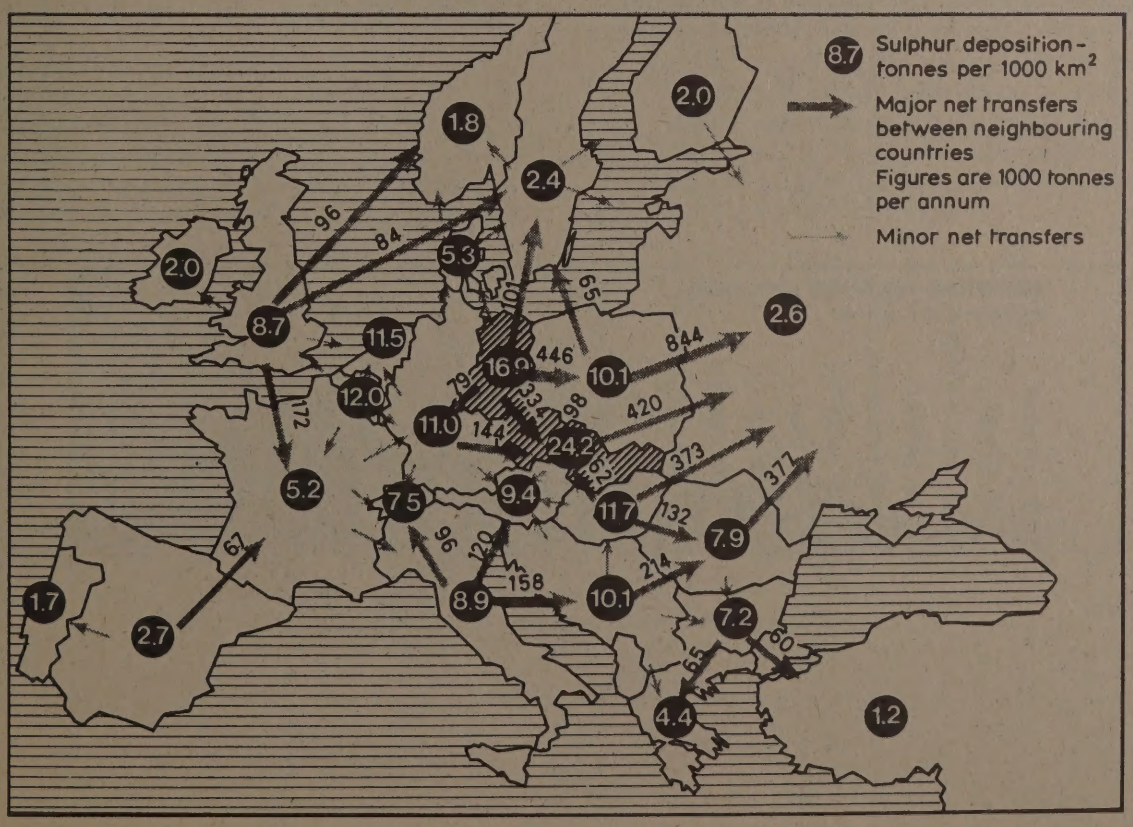
Scientists estimate that acidification begins in most Scandinavian lakes when sulphur is deposited at around 0.5 grammes per square metre per year. Some Swedish scientists put the "safe load" for their most sensitive lakes even lower, at 0.3 grammes. The current rate of deposition is around 2-3 g/sq.m/year. For 10 years now the rates of deposition in Scandinavia have remained stable as emission rates have stabilized in recession-hit Britain and elsewhere. But the Norwegian scientist Ivar Muniz told the Stockholm conference there were "no signs of levelling off in the progressive acidification of lakes." The reason for this is likely to be that the environment is becoming steadily more sensitive to acid. More than half the brown trout of Norway are lost and Muniz says "if this trend persists more than 80%... will vanish during this decade." Trout losses in the north of the country are now "strikingly similar to the situation we experienced in the south."

The Swedish Environmental Protection Board warns that "the acid load in southern Scandinavia has to be reduced to at least one-third of today's load, if all the former good fishing waters are to be saved."

The map shows were sulphur lands in Europe. The arrows show how sulphur flows between neighbouring countries. The rates of deposits are highest in Czechoslovakia and East Germany, which also emit the most. The East Germans burn sulphurous lignite coal and, like other East European countries, are reluctant to spend money on pollution controls. Damage to crops, forests and rivers is widespread in these countries. East Germany has recently overtaken Britain as the leading source of sulphur pollution in Sweden.

Britain is freer than any other country in Europe from other people's emissions. Yugoslavia is the principal source of sulphur imports to five neighbouring countries. The power stations and factories of northern Italy may be starting to kill fish and forests in Switzerland and Austria. The map does not show the full extent of sulphur exports to the Soviet Union : 30% of all Europe's emissions land up there. Britain sends 6% of all its emissions to Russia.

Perhaps the most remarkable feature of the map, however, is the low level of deposition in Scandinavia, where highly sensitive soils cause some of the worst acid rain effects found anywhere.



THERE IS NO denying that the cost of cutting emissions of sulphur across Europe and North America would be vast. How vast, nobody is quite sure, though advances in technology make the options increasingly attractive. Even the British government is more or less committed to putting equipment to remove sulphur into any new coal- or oil-fired power stations (though, having revived its programme for nuclear energy, it has no plans to build more conventional plants).

In Stockholm the environment director of the international, independent Organization of Economic Cooperation and Development, Jim MacNeill, predicted that Europe could make a 50% reduction in sulphur emissions within a few years at a cost of some £2.5 million. This was, he said, "a large sum, but a sum exceeded by conservative estimates of the savings that would result... in the form of avoidable damage costs to lake quality, to the productivity of fresh water ecosystems, to crops and buildings." But Leslie Reed, Britain's chief alkali inspector and thus the country's air pollution "supremo", reckoned that such a sum would cut emissions by only 25%. This would put 10-15% on the nations's electricity bill, he said.

There are a number of ways of cutting the emission of sulphur from power stations (which are responsible for some 60% of all emissions) and from industrial boilers. Any sensible abatement strategy would use a combination of them.

● **Low-sulphur fuels.** In Britain the average sulphur content of coal used in power stations is 1.6%. Sweden has passed legislation limiting sulphur content to 1%. In Britain oil power stations are on average 10% "dirtier" than coal stations. Low-sulphur fuels are scarce. But modern oil refineries can produce more low-sulphur oil and most coals can be cleaned. The Stockholm conference concluded that at least 25% of sulphur in bituminous coal could be removed by crushing and cleaning. But lignite, for example, cannot be cleaned using existing technology. This is unfortunate because East Germany, the biggest exporter of acid rain to Sweden, is powered almost entirely by the country's massive lignite resources.

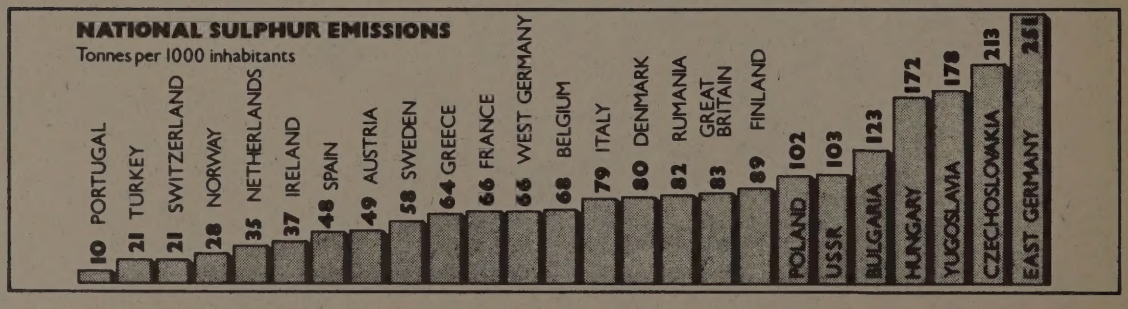
● **New burners** with limestone-injection systems will cut emission both of sulphur and nitrogen oxide. Pilot tests suggest that these burners can remove up to 80% of sulphur dioxide. Lime can also be added to fluidised bed combustion systems. These systems may soon be widely used for smaller industrial boilers in pollution conscious countries.

● **The sulphur can be removed** after combustion but before the gases leave the stack. "Flue gas desulphurisation" systems are now proven technology in increasing use for large power stations. The gases are washed by an alkaline solution which converts the sulphur dioxide to a waste sludge. The systems can remove anything up to 95% of the sulphur from flue gases.

Countries with an urgent need (or at any rate the political will) to set about cutting emissions have generally opted for flue gas desulphurisation. Sweden has an extensive programme for the next 10 years and West Germany is talking in similar terms. Even the United States has installed some desulphurisation equipment in plants in sensitive areas. But in Britain, Reed says that it would be impossible. "Retrofitting requires extra land and a major reconstruction of the plant", he said. He looks instead to long-term technological developments which may make it cheaper to remove sulphur. Industrial boilers may use fluidised bed systems. Power stations will fit burners with limestone injection systems after they are fully developed.

Around the year 2000, Reed sees these technologies bringing assured reductions in the emission of sulphur. In the meantime he told the Stockholm conference, "There appears to be little justification for massive expenditure on retrofitting existing installations with equipment to reduce sulphur dioxide emissions merely to bring forward a few years a decline in emissions which would have occurred in the absence of any action."

Many people see this British "logic" as simple expediency. The Stockholm experts appeared to agree. The conference accepted that technologies are developing encouragingly and that the costs of installing cleaning equipment would fall. But it concluded quite unequivocally: "These developments are expected to occur gradually and therefore do not justify delaying the use of available abatement technologies." In the coming years the battle between Britain and the Scandinavians will centre increasingly on the question of whether Britain should add retrofit flue-gas desulphurisation units to existing power stations. In the meantime, if Ulrich is right, the damage in many areas may have gone beyond the point of no return. ■



PUBLICATIONS FROM CHURCH AND SOCIETY

There exist a number of publications concerning specific consultations and studies which were organized by the Sub-unit on Church and Society in the recent past. The publications below are all available, either from the Sub-unit on Church and Society itself, or from the Publications office of the WCC.

I. CONCERNING ENERGY

1. ENERGY FOR MY NEIGHBOUR — PERSPECTIVES FROM ASIA. The official report of the two regional consultations held in Asia by the Energy for my Neighbour Programme in March 1981. This 158 page book contains all the papers presented to the consultations, as well as the reports of the various working groups. It is available in full only in English.

2. ENERGIA PARA MI PROJIMO — LIMA 1981, a special issue of *Anticipation* in Spanish and Portugese prepared as preparatory material for the Latin American regional consultation. Amongst a number of articles in this 134 page publication written by people in Latin America, there is also a Spanish translation of the report of the working groups of the Asian regional consultations.

3. ENERGIA PARA MI PROJIMO — PERSPECTIVAS DE AMERICA LATINA. The official report of the Latin American regional consultation held by the Energy for my Neighbour Programme in Peru, October 1981. This 142 page book contains all the papers presented to the consultation, as well as the reports of the working groups. The book is available in the Spanish original, as well as an abridged (58 page) English version.

II. CONCERNING THE REST OF THE WORK OF CHURCH AND SOCIETY

4. BEFORE IT'S TOO LATE. The report of the Hearing Group of the International Public Hearing on Nuclear Weapons and Disarmament. This Hearing was organized by the WCC at the Free University in Amsterdam, November 1981. This 24 page report is available in the original English version, as well as in French and German translations.

5. BEFORE IT'S TOO LATE. The full report of this Public Hearing will be published in a book of approximately 300 pages in December 1982. In addition to the actual report of the Hearing Group, all the testimonies of the 38 expert witnesses, the questions of the Hearing Group to these witnesses and their replies will be included. The full report is only available in English.

6. MANIPULATING LIFE — Ethical Issues in Genetic Engineering. The report of the Working Group on "Ethical and Social Issues in Genetic Engineering and the Ownership of Life Forms", which met in Vogelenzang, the Netherlands in June 1981. This 48 page booklet was updated in June 1982 before publication by the Working Committee of Church and Society.

III. OTHER PUBLICATIONS PLANNED BEFORE THE ASSEMBLY

7. ANTICIPATION — No. 30 is expected to be published early in 1983, as the last issue before the Assembly. This will include the report of the last meeting of the Working Committee on Church and Society, concerning the contribution of this Sub-unit to the programme of the Assembly, as well as proposals for future work.

8. THE ENERGY NETWORK is also expected to be published early in 1983. It will include detailed information about 150 groups and organizations throughout the world working in the area of renewable energy development, at technical as well as socio-political levels. The list will include government, church and privately sponsored organizations, with information on their size, activities and affiliation. It is expected that this book will be a useful resource for those involved in energy assistance at international levels.

9. TOWARDS MORE JUST AND SUSTAINABLE ENERGY POLICIES will contain resource materials for churches and other individuals and groups committed to doing work in the area of energy. It will be based on the eight years of ecumenical activity in energy. The publication will be around the middle of 1983.

CHARITY

I see humanity as a herd of cattle inside a fenced enclosure. Outside the fence are green pastures with plenty for the cattle to eat, while inside the fence there is not quite enough grass for the cattle. Consequently, the cattle are trampling underfoot what little grass there is and goring each other to death in their struggle for existence.

I saw the owner of the herd come to them and when he saw their pitiable condition he was filled with compassion for them, and he thought of what he could to do improve their condition. So he called his friends together and asked them to assist him in cutting the grass from the outside and throwing it over the fence to the cattle. And they called that charity.

Then, because the calves were dying off and not growing into servicable cattle, he arranged that they should each have a pint of milk every morning for breakfast. Because they were dying off in the cold night he put up beautiful, well-drained and well-ventilated cow sheds for the cattle. Because they were goring each other in their struggle for existence he put corks on the horns of the cattle so that the wounds they gave each other might not be so serious. Then he reserved a part of the enclosure for the old bulls and the old cows over seventy years of age. In fact he did everything he could do to improve the condition of the cattle.

And when they asked him why he did not do the obvious thing — break down the fences and let the cattle out, he answered : "If I let the cattle out, I should no longer be able to milk them."

Leo Tolstoy
(1828-1910)